

7327

ANNUAL REPORT
OF THE
PANAMANIAN CANAL
COMMISSION
AND
THE PANAMA CANAL

FOR THE
FISCAL YEAR
ENDED JUNE 30
1914



WASHINGTON
GOVERNMENT PRINTING OFFICE
1914





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ISTHMIAN CANAL
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ERRATUM.

[Annual report of the Isthmian Canal Commission and the Panama Canal for the fiscal year ending June 30, 1914.]

The use of the expression "kilowatt volt ampere" throughout this report is erroneous. The usual expression "KVA," which was used in the original manuscript, should have been printed.

63399°—14

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1914

TABLE OF CONTENTS.

	Page.
Report of the Governor of the Panama Canal-----	1
Organization -----	1
Construction -----	5
Personnel -----	5
Locks and dams -----	6
Gatun Locks -----	6
Gatun Spillway -----	7
Gatun Dam -----	7
Pedro Miguel Locks -----	8
Miraflones Locks -----	9
Miraflones Dam and Spillway -----	9
Lock gates -----	10
Gate machines -----	11
Miter forcing machines -----	11
Rising stem valves -----	12
Guard valves -----	12
Auxiliary culvert valves -----	12
Cylindrical valve machines -----	12
Chain fender machines -----	13
Spillway gates -----	13
Towing-track material -----	13
Towing locomotives -----	14
Illumination of the locks -----	14
Remote control -----	14
Hydroelectric plant -----	15
High-power transmission line -----	17
Cables -----	17
Telephone system -----	17
Emergency dams -----	17
Floating caissons -----	18
Pontoon bridge -----	18
Operation of the locks -----	19
Electrical division -----	22
Municipal engineering -----	23
Meteorology and hydrography -----	26
General surveys -----	27
Aids to navigation -----	27
Dry excavation -----	28
Dredging -----	31
Mechanical division -----	34
Division of terminals -----	35
Dry docks -----	35
Balboa coaling station -----	36
Shops -----	37
Breakwaters -----	38

Report of the governor of the Panama Canal—Continued.

Construction—Continued.

Division of terminals—Continued.	Page.
Cristobal coaling plant.....	40
Fuel-oil plants.....	40
Quay walls and pier.....	41
Ancon quarry.....	43
Sand service.....	44
Panama Railroad freight yards.....	44
Colliers	44
Tugs	45
Floating cranes.....	45
Balboa town site.....	45
Radio station	46
Supply department.....	46
Cost keeping	50
Accounting department.....	52
Executive department	54
Customs service.....	54
Administration of estates.....	54
Division of posts.....	55
Division of schools.....	55
Police and fire division.....	56
Courts	57
Timekeeping	60
Clubs and playgrounds.....	60
Canal Record.....	61
Law.....	61
Washington office	62
Operation and maintenance.....	63
Sanitation	64
Division of hospitals and charities.....	64
Sanitary division	64
Quarantine division	65
Fortifications	65

APPENDIX A.

Report of the engineer of maintenance.....	67
Lock gates and protective devices.....	68
Chain fenders	70
Chain	71
Lock entrance caissons.....	71
Pontoon bridge	72
Transfer of the work.....	73
Operating machinery and electrical installation—Division of erection.....	73
Concrete	74
Hydroelectric generating station.....	74
Transmission line.....	74
Lock machinery.....	74
Spillway machines.....	74
Control board.....	74
Lockages	74
Hydraulics of the locks.....	76

TABLE OF CONTENTS.

V

Report of the engineer of maintenance—Continued.	Page.
Emergency dams.....	85
Electrical division.....	85
Division office and designing force.....	86
Operation of power plants.....	86
Operation of air compressor plants.....	87
Maintenance of building and street lighting system.....	88
Transmission and distribution line construction and maintenance work.....	88
Electrical work in permanent buildings.....	89
Electrical work in new Balboa shops.....	89
Operation and maintenance of electric cargo-handling cranes.....	89
Miscellaneous.....	90
Division of municipal engineering.....	90
Office engineer.....	91
Section of meteorology and hydrography.....	91
Discharge at the spillway.....	91
Leakage at spillway.....	92
General surveys.....	92
Division of lighthouses.....	93

APPENDIX A-1.

Report of electrical and mechanical engineer.....	95
Erection work—Concrete.....	96
Gatun hydroelectric station.....	96
Transmission line material.....	96
Gatun substation.....	97
Cristobal substation.....	99
Miraflores substation.....	99
Balboa substation.....	100
Darien substation.....	100
Gamboa substation.....	100
Transmission line system.....	100
Track span bridges.....	100
Transmission lines.....	101
Transmission line strain and suspension insulators.....	101
Lock machinery.....	102
Rising stem gate valve machines—Mechanical equipment.....	102
Rising stem gate valve machines—Electrical equipment.....	102
Operation.....	102
Operation of rising stem gate valve machines under full head.....	102
Cylindrical valve machines.....	103
Auxiliary culvert valve machines.....	104
Guard valve machines.....	104
Tests on guard valves.....	104
Miter-gate moving machines.....	105
Miter-gate moving machine tests.....	106
Miter-gate forcing machines.....	107
Tests on miter gate-forcing machines.....	108
Towing track material.....	108
Rack track.....	108
Conductor-slot material.....	108
Conductor slots.....	109
Crossovers and turnouts.....	109

Report of electrical and mechanical engineer—Continued.	Page.
Towing locomotives.....	109
Distribution of locomotives.....	109
Spillway gate machines.....	110
Tests and operation.....	110
Lock transformer-room equipment.....	110
Special transformer-room equipment.....	110
Insulated cable.....	111
Chain-fender machines.....	112
Handrail-operating machines.....	113
Chain-fender sump pumps.....	113
Drainage sump and culvert pumps and motors.....	114
Operating tunnel doors.....	114
Illumination	114
Lockages	115
Up lockage of tug <i>Gatun</i>	115
Return lockage of tug <i>Gatun</i> from Gatun Lake to sea.....	115
Lockage of steamship <i>Allianca</i>	116
Lockages at Pedro Miguel.....	117
Lockages at Miraflores Locks.....	118
Lockage of the <i>Santa Clara</i>	118
Lockage of the steamship <i>Ancon</i>	119
Emergency dams.....	119
Tests	119
Telephone system.....	120
Telephone equipment.....	120
Lock-control switchboards.....	122
Sump pumps, for Cristobal and Balboa substations.....	124
Snubbing posts.....	124
Pumps and motors for cable crossovers.....	125

APPENDIX A-2.

Report of resident engineer, division of municipal engineering.....	127
Northern district.....	128
Southern district.....	129
Waterworks for southern end of canal.....	132
Operation of purification plants.....	136
Designs	138

APPENDIX A-3.

Report of chief hydrographer, section of meteorology and hydrography---	141
Personnel.....	141
Meteorology.....	141
Precipitation.....	142
Temperature.....	142
Wind.....	143
Atmospheric pressure.....	143
Relative humidity.....	144
Cloudiness.....	144
Evaporation.....	144
Fogs.....	144
Sea temperature.....	144
Tidal conditions.....	144

Report of chief hydrographer, etc.—Continued.

Meteorology—Continued.

	Page.
Seismology.....	144
Monthly rainfall on Isthmus of Panama.....	145
Maximum rainfall in Canal Zone.....	146
Monthly meteorological data—	
Ancon, year 1913.....	147
Culebra, year 1913.....	148
Colon, year 1913.....	149
Monthly evaporation, Canal Zone, years 1913, 1914, and averages.....	150
Tidal conditions, year 1913.....	150
Seismograph records, Ancon, fiscal year.....	150
Hydrography	154
General	154
Gatun	155
Gamboa	156
Alhajuela	156
Vigia	156
Rating station.....	156
Special investigations.....	156
Currents in Colon Harbor.....	156
Leakage at Gatun Spillway gates.....	157
Seepage west emergency dam pit, Miraflores Locks.....	158
Hydraulic conditions below Miraflores Spillway.....	158
Current observations below west lower operating gates at Miraflores Locks.....	159
Monthly discharge—Chagres River.....	161
Monthly maximum, minimum, and mean elevations, Chagres River and Gatun and Miraflores Lakes.....	162
Principal freshets.....	163
Data on slopes of Chagres River and Gatun Lake during freshet period of Nov. 10–11, 1913.....	164
Data on slopes of Chagres River and Gatun Lake during freshet period of May 21–22, 1914.....	164

APPENDIX B.

Report of the engineer of terminal construction.....	165
Organization.....	165
General	166
Design, drafting, and inspection.....	166
Permanent shops.....	166
Steelwork	167
Closures.....	167
Roofing.....	168
Power and lighting distribution.....	168
Motors	169
Foundations	170
Flooring.....	171
Installation of mechanical division and shops.....	171
Shops office	171
Contracts.....	171
Equipment installed.....	171
Surface drainage.....	171

Report of the engineer of terminal construction—Continued.

Installation of mechanical division and shops—Continued.

	Page.
Piping-----	172
Weight of steel, date of acceptance, and contract payments—Balboa shop buildings-----	172
Amount of tile erected on permanent shop buildings-----	173
Amount of roof tile manufactured by American Cement Tile Co.--	173
Amount of Barrett specification roofing erected in permanent shop buildings-----	173
Horsepower of motors and their distribution in Balboa shop buildings-----	174
Number and size of lights in Balboa shop buildings-----	174
Calculated illumination in Balboa shop buildings-----	175
Per cent completion of electrical installations, Balboa shop buildings-----	176
Floor area, in square feet, of various departments of permanent shop buildings-----	177
Contracts placed for material for permanent shops-----	177
Old and new equipment installed in Balboa shops-----	179
Coaling plants, dry docks, floating cranes, and radio stations-----	180
Designs-----	180
Coaling plants-----	180
Military usefulness-----	187
Commercial usefulness-----	187
Canal usefulness-----	187
Colliers-----	188
Dry docks-----	189
Floating cranes-----	190
Pontoons-----	191
Machinery-----	191
Electrical equipment-----	191
Erection-----	192
Radio stations-----	192
Fuel-oil plants-----	194
Pier and wharf construction—Pacific terminals-----	195
General-----	195
Quay wall "G H I" and Pier No. 1-----	196
Small-boat landings-----	196
Quay walls "D E" and "E F"-----	196
Unloader and reloader wharves-----	197
Tugs-----	197
Dimensions of tugs-----	199
Hull and machinery-----	199
Boilers and engines-----	199
Inspection-----	199
Construction work—Pacific terminals-----	199
Pacific terminal construction-----	200
General-----	200
Steam-shovel excavation-----	200
Cofferdam-----	200
Dry Dock No. 1-----	201
Dry Dock No. 2-----	202
Entrance basin-----	202

Report of the engineer of terminal construction—Continued.

Construction work—Pacific terminals—Continued.

	Page.
Balboa coaling plant.....	203
Excavation.....	203
Concrete.....	203
Filling and embankment.....	203
Quay walls and piers.....	204
Quay wall "G H I".....	204
Bulkhead quay wall "I J M N".....	204
Pier No. 1.....	205
Quay wall "E F".....	205
Shops.....	206
Machine foundations.....	206
Shops tunnel.....	206
Drainage.....	206
Precise levels.....	207
Panama Railroad yards.....	207
Curundu River culvert.....	207
Reclamation of land.....	207
Removal of berm cranes from Miraflores.....	207
Naos Breakwater.....	207
Ancon quarry.....	208
Sand service.....	209
Personnel.....	209
Work done, Pacific terminals, fiscal year.....	209
Excavation by steam shovels, Pacific terminals.....	210
Drilling, Pacific terminals.....	211
Dynamite used, Pacific terminals.....	212
Piles driven, track laid, track removed, Pacific terminals.....	212
Reinforcing steel, Pacific terminals.....	213
Fixed steel, Pacific terminals.....	214
Performance of steam shovels, Pacific terminals.....	214
Progress of caisson operations, Pacific terminals.....	215
Concrete placed, Pacific terminals.....	216
Material placed on Naos Island Breakwater.....	217
Operations, Ancon quarry.....	218
Sand unloaded from barges.....	218
Principal items of hand excavation, Pacific terminals.....	219
Pile trestles constructed, Pacific terminals.....	221
Ditches dug, Pacific terminals.....	221
Miscellaneous work done, Pacific terminals.....	222
Construction work—Pacific terminals—Balboa town-site subdivision.....	223
Balboa town site.....	223
Drainage and sewerage.....	224
Water supply and fire protection.....	224
Paving.....	224
Light and power.....	225
Location of subsurface structures.....	225
Plant propagation.....	225
Other work.....	225
Balboa town-site work completed, fiscal year.....	225
Atlantic terminals—Construction.....	226
General.....	226
Breakwater quarry, Porto Bello.....	226

Report of the engineer of terminal construction—Continued.

Atlantic terminals—Construction—Continued.

Page.

Water transportation-----	226
West breakwater, Colon-----	227
East breakwater-----	227
Construction work—Atlantic terminals-----	229
Subdivision of Cristobal coaling plant-----	229

APPENDIX C.

Report of resident engineer, dredging division-----	233
Division organization-----	233
Dredging-----	233
Yardage removed, first district—	
Pedro Miguel Locks to sea-----	235
Culebra Cut, Pedro Miguel Locks to Gamboa Dike-----	235
Yardage removed, second district-----	236
Dredges retired for repairs and renewals-----	236
Subaqueous rock excavation-----	236
First district (Pedro Miguel Locks to sea)-----	236
First district (Culebra Cut)-----	237
Second district-----	237
Dredging operations-----	237
Atlantic entrance-----	237
Gatun Lake-----	237
Culebra Cut-----	238
Miraflores Lake-----	238
Pacific entrance-----	238
Atlantic terminals-----	238
Miscellaneous-----	238
Clearings and diversions-----	240
Paraiso Wharf-----	240
Pontoon bridge-----	240
Water hyacinths-----	241
Dry excavation-----	241
Culebra Cut-----	241
Surveys-----	241
Office-----	242

APPENDIX D.

Report of superintendent—Mechanical division-----	243
Balboa shops-----	243
Cristobal shops and dry dock-----	244
Paraiso shops-----	245
Apparatus surveyed and retired either for sale or shipment elsewhere-----	250
Equipment in actual service, or awaiting survey for retirement-----	251
Value of work performed by mechanical division, including Balboa, Paraiso, and Cristobal Dry Dock shops—Abstract of expenditures--	253
Value of work performed by mechanical division, including Balboa, Paraiso, and Cristobal Dry Dock shops, for individuals and companies-----	253
Value of work performed by mechanical division, exclusive of Cristobal Dry Dock shops and Paraiso shops—Abstract of expenditures--	253

Report of superintendent—Mechanical division—Continued.	Page.
Value of work performed by mechanical division, exclusive of Cristobal Dry Dock shops and Paraiso shops, for individuals and companies	254
Value of work performed by Cristobal dry-dock shops—Abstract of expenditures.....	254
Value of work performed by Cristobal dry-dock shops for individuals and companies.....	254
Value of work performed by Paraiso shops—Abstract of expenditures..	255
Value of work performed by Paraiso shops for individuals and companies.....	255
Total overtime of Paraiso shops and Cristobal dry-dock shops, with per cent of total pay roll.....	255
Total overtime of Cristobal dry-dock shops, with per cent of total pay roll.....	256
Total overtime of Paraiso shops, with per cent of total pay roll....	256
Actual shop expense percentage, dry-dock shops and Paraiso shops..	256
Applied shop expense percentage, dry-dock shops and Paraiso shops..	257
Output and cost of brass castings.....	257
Output and cost of iron castings.....	258
Output and cost of steel castings.....	258
Number of repairs to locomotives.....	259
Repairs made to equipment other than locomotives and cars.....	259
Number of shop and field repairs made to different classes of cars..	259
Hostling cost.....	260

APPENDIX E.

Report of superintendent, division of canal transportation.....	261
Division organization	261
Captains of the ports.....	261
Board of local inspectors.....	262
Lighthouse Service.....	262
Board of admeasurement.....	262
Appendix	263
Report of board of local inspectors.....	263
Organization and personnel.....	263
Navigation laws, etc.....	263
Accidents and investigations.....	263
Steamboat inspection	264
Licenses issued.....	265
Chauffeurs	265
Navigators of motor boats.....	266
Licenses revoked	266
Licenses refused.....	266
EXHIBIT 1—Officers' licenses issued.....	266
EXHIBIT 2—Inspection made and revenues received.....	267

APPENDIX F.

Report of the chief quartermaster, supply department.....	269
Organization.....	269
Personnel.....	270
Labor.....	270

Report of the chief quartermaster, supply department—Continued.	Page.
Quarters.....	271
Zone sanitation.....	273
Corrals.....	273
Building construction.....	274
Material and supplies.....	277
Receipts.....	277
Operations of stores.....	277
Mount Hope.....	279
Paraiso.....	280
Gatun.....	280
Balboa.....	280
General.....	281
Scrap.....	281
Sales.....	284
Subsistence.....	288
Commissary branch.....	290
EXHIBIT 1.—Force actually at work June 30, 1914.....	292
EXHIBIT 2.—Force report, by months (including contractors' forces), fiscal year.....	293
EXHIBIT 3.—High and low force records, December, 1906, to June 30, 1914.....	293
EXHIBIT 4.—Contract laborers brought to Isthmus by Isthmian Canal Commission.....	294
EXHIBIT 5.—Analysis of transportation from the Isthmus.....	295
EXHIBIT 6.—Occupants of Panama Canal and Panama Railroad quarters, June 30, 1914.....	297
EXHIBIT 7.—Applications for married quarters on file June 30, 1914.....	297
EXHIBIT 8.—Animals in corrals June 30, 1914.....	297
EXHIBIT 9.—Number of buildings on the Canal Zone June 30, 1914.....	298
EXHIBIT 10.—New frame structures, fiscal year.....	298
EXHIBIT 11.—Buildings sold and demolished, fiscal year.....	299
EXHIBIT 12.—Value of material received during fiscal year on requisitions of various departments.....	300
EXHIBIT 13.—Freight statement, fiscal year.....	302
EXHIBIT 14.—Important items due on United States requisitions June 30, 1914.....	302
EXHIBIT 15.—Important items of material purchased from inception of canal work, 1904 to June 30, 1914.....	302
EXHIBIT 16.—Important items of material received, fiscal year.....	303
EXHIBIT 17.—Classification of material in stock at storehouses, June 30, 1914.....	304
EXHIBIT 18.—Value of stock on hand at warehouses, June 30, 1914.....	305
EXHIBIT 19.—Rolling stock, July 1, 1914.....	305
EXHIBIT 20.—Important items of equipment sold.....	306
EXHIBIT 21.—Pending sales of important items of equipment, June 30, 1914.....	307
EXHIBIT 22.—Statement of rail sold.....	307
EXHIBIT 23.—Operation of Hotel Tivoli, fiscal year.....	308
EXHIBIT 24.—Summary of operations, line hotels, restaurants, and European laborers' messes.....	309
APPENDIX.—Report of resident engineer, permanent building division.....	311
Administration building.....	312
Permanent quarters.....	313

Report of the chief quartermaster, supply department—Continued.

APPENDIX.—Report of resident engineer, etc.—Continued.

	Page.
Hydroelectric station power plant.....	314
Transmission line substations.....	315
Gatun substation.....	316
Miraflores substation.....	316
Cristobal substation.....	317
Balboa substation.....	318
Commissary warehouse.....	318
Commissary, Balboa	319
Shops office, Building No. 28.....	319
Fire station	320
Schoolhouse	320
Radio stations.....	320
Darien radio station.....	320
Colon radio station.....	321
Balboa radio station.....	321
Lock control houses.....	321
Ancon commissary	322
Force	322

APPENDIX G.

Report of auditor, accounting department.....	323
Organization.....	323
Permanent accounting system.....	324
Panama and Colon waterworks accounts.....	326
Miscellaneous work	326
Canal Zone accounts.....	328
Claims for injuries and deaths.....	329
Canal appropriations.....	330
Tables submitted with report (for index see p. 332).....	332

APPENDIX H.

Report of chief health officer, department of health (for index see p. 375) ..	375
--	-----

APPENDIX I-1.

Report of executive secretary, executive department.....	403
Organization	403
Executive office.....	404
Clerical bureau.....	405
Personal bureau.....	405
Time-keeping bureau	405
Cost-keeping bureau.....	405
Bureau of clubs and playgrounds.....	405
Changes in buildings.....	405
New activities	406
Membership	406
Entertainments.....	407
Physical work and athletics.....	407
Religious work.....	408
Educational work	408
Boys' work	408
Finances	408

Report of executive secretary, executive department—Continued.

Organization—Continued.

Executive office—Continued.

	Page.
Special attorney's office-----	409
Division of civil affairs-----	409
Licenses and taxes-----	409
Customs service-----	409
Administration of estates-----	410
Division of posts-----	410
Division of schools-----	412
Police and fire division-----	413
Police and prisons-----	413
Fire protection-----	415
Courts-----	417
Marshal-----	419
Relations with Panama and foreign representatives-----	419
Legislation-----	421
Appendices to report (for table of contents, see p. 422)-----	422

APPENDIX I-2.

Report of cost-keeping accountant-----	443
EXHIBIT A.—Statement of construction expenditures to June 30, 1914-----	443
Total cost by geographical divisions-----	444
Percentage of surcharge over construction cost-----	444
Total construction cost for various units of work-----	444
Dry excavation-----	445
Masonry-----	446
Dry filling-----	447
EXHIBIT B.—Detailed cost per unit of work-----	448
TABLE 1.—Dredging excavation-----	448
TABLE 2.—Hydraulic excavation-----	449
TABLE 3.—Colon west breakwater-----	449
TABLE 4.—Stone production-----	449
TABLE 5.—Sand production-----	450
EXHIBIT C.—Detailed cost to June 30, 1914-----	450
TABLE 1.—Spillway gates, caissons, and machinery, lock gates and fender chains, emergency dams, hydroelectric power plant-----	450
TABLE 2.—Lock-operating machinery-----	450
TABLE 3.—Transmission system-----	452
TABLE 4.—Aids to navigation-----	452
TABLE 5.—Cristobal terminals-----	452
TABLE 6.—Balboa terminals-----	453
TABLE 7.—Permanent town sites-----	454
TABLE 8.—Permanent buildings-----	454
TABLE 9.—Cost of buildings erected by supply department and charged to other units of construction-----	455
EXHIBIT D.—Comparative statement of administrative and general expenses for fiscal year-----	455
Exhibits to report (for table of contents see p. 456)-----	456

APPENDIX I-3.

	Page.
Report of special attorney-----	511
Legislation-----	511
Organization-----	514
Criminal matters-----	517
Civil cases in the Canal Zone courts in which the United States and the Panama Railroad Co. are interested-----	521
Claims disposed of without suit-----	523

APPENDIX J.

Report of the general purchasing officer and chief of the Washington office-----	525
---	-----

APPENDIX K.

Tables showing increases in salaries and personnel-----	531
Department of operation and maintenance-----	531
Supply department-----	545
Accounting department-----	547
Department of health-----	548
Executive department-----	548
Office of special attorney-----	550
Washington office-----	551

APPENDIX L.

Acts of Congress affecting the Panama Canal and Executive orders relat- ing to the Canal Zone (for index see p. 553)-----	553
--	-----

APPENDIX M.

Charts showing organization of The Panama Canal and Panama Railroad Co., July, 1914 (for index see p. 603)-----	603
--	-----

LIST OF ILLUSTRATIONS.

APPENDIX A.

[Report of Engineer of Maintenance.]

Plate.

1. Pedro Miguel Lock. East chamber, looking north. All valves in east wall fully open. February 21, 1914.
2. Pedro Miguel Lock. East chamber, looking north. Discharge showing complete from the 11 culverts of east wall. February 21, 1914.
3. Operation of Miraflores Locks. S. S. *Santa Clara* in lower west chamber, lock filling. Looking south. June 18, 1914.
4. Operation of Miraflores Locks. S. S. *Santa Clara* in upper west chamber, lock filling. Looking south. June 18, 1914.
5. Operation of Gatun Locks. East emergency dam subjected to head of 50 feet of water. Looking south from intermediate gates. May 6, 1914.
6. Operation of Gatun Locks. First boat through. Tug *Gatun* entering lower lock, west chamber. Looking south from forbay. September 26, 1913.
7. Operation of Gatun Locks. S. S. *Ancon* leaving upper west chamber and entering the lake.
9. Gatun spillway dam completed, and hydroelectric station under construction. December 30, 1913.
9. Gatun spillway dam completed and hydroelectric station under construction. Looking south. February 7, 1914.
10. Gatun hydroelectric station. Exterior of gatehouse.
11. Pedro Miguel Lock. General view from Luisa Hill. June 6, 1914.
12. Pedro Miguel Lock. West chamber, illuminated.
13. Pedro Miguel Lock. Control house.
14. Operation of Miraflores Locks. S. S. *Santa Clara* in upper west chamber. Lock filling. Looking south. June 18, 1914.
15. Miraflores Locks. Control board.

Following plates, 71 to 75 and 136, in portfolio.

71. Diagram showing area of cross section at different points of filling culverts.
72. Pedro Miguel Lock. Characteristics of side-wall culvert. Filling curve for 900-foot lock through east culvert, using two valves.
73. Pedro Miguel Lock. Characteristics of side-wall culvert. Filling curve for 900-foot lock through east culvert, using one valve.
74. Pedro Miguel Lock. Oscillations of water level in forebay after opening filling valves in one culvert.
75. Pedro Miguel Lock. Oscillations of water level in forebay after opening filling valves in two culverts.
136. Pontoon bridge at Paraiso.

APPENDIX A-1.

[Report of electrical and mechanical engineer.]

Following plates, 76 to 95, in portfolio.

Plate.

76. Miraflores Locks. Head-torque characteristics of rising stem gate-valve machines.
77. Miter-gate moving machine. Current-duty cycle for opening gates Nos. 31 and 32.
78. Miter-gate moving machine. Current-duty cycle for closing gates Nos. 31 and 32.
79. Miter-gate moving machine. Current-duty cycle for opening gates Nos. 31 and 32.
80. Miter-gate moving machine. Current-duty cycle for closing gates Nos. 31 and 32.
81. Gatun Locks. Miter-gate moving machine. Maximum current of duty cycle for nonsimultaneous operation of gates. Opening miter gates Nos. 31 and 32.
82. Gatun Locks. Miter-gate moving machine. Maximum current of duty cycle for nonsimultaneous operation of gates. Closing miter gates Nos. 31 and 32.
83. Gatun Locks. Miter-gate moving machine. Maximum strut compression for nonsimultaneous operation of opening miter gates Nos. 31 and 32.
84. Gatun Locks. Miter-gate moving machine. Maximum strut compression for nonsimultaneous operation of closing miter gates Nos. 31 and 32.
85. Miraflores Lock. Towing locomotive. Current-duty cycle for ascending and descending incline at west wall.
86. Gatun Locks. Graphic wattmeter curve power demand. November 18, 1913.
87. Gatun Locks. Illumination. Cut-off distances for concrete reflectors of lamp standards, elevation of eye, 3 feet 6 inches above the rail. Lamp standard No. 194.
88. Gatun Locks. Illumination. Center-wall illumination with all lights on. Values taken at a point 3 feet 6 inches above rail on center wall, west side of the middle level. New, rough, whitewashed reflectors.
89. Gatun Locks. Illumination. Center-wall illumination with all lights on. Values taken at a point 3 feet 6 inches above the rail on center wall, west side of the middle level. Whitewashed reflectors, old and soiled.
90. Gatun Locks. Illumination. Profile of west wall giving illumination at a point 3 feet 6 inches above rail, using whitewashed reflectors, old but moderately clean. Lamp standard No. 280.
91. Gatun Locks. Log tests made in towing S. S. *Allianca* through locks. June 8, 1914.
92. Gatun Locks. Measurement of rise of wedges above seats under full head, emergency Dam A.
93. Gatun Locks. Curves of horizontal deflection of downstream chord of the horizontal truss of emergency Dam A.
94. Gatun Locks. Curves of vertical deflection of downstream chord of the horizontal truss of emergency Dam A.
95. Gatun Locks. Leakage of emergency Dam A.

APPENDIX A-2.

[Report of resident engineer, division of municipal engineering.]

Plate.

16. Agua Clara purification plant. General view looking south. April 4, 1913.
17. Mount Hope waterworks and purification plant, showing sedimentation basin, aeration basin, and filter building.
18. Mount Hope waterworks and purification plant. Front view filter building and pump station.
19. Miraflores water-purification plant. Wash-water tank. Looking south. May 30, 1914.

Following plates, 96 to 98, in portfolio.

96. Miraflores purification plant. Elevation plan and section.
97. Miraflores purification plant. Filter buildings, general location, plans and sections.
98. Chlorine chart, Miraflores Lake.

APPENDIX A-3.

[Report of chief hydrographer, section of meteorology and hydrography.]

Following plates, 99 to 112, in portfolio.

Plate.

99. Wind roses, year 1913.
100. Hydrograph of Gatun Lake.
101. Hydrograph of Miraflores Lake.
102. Mass curve of total yield, Gatun Lake.
103. Rainfall, runoff and percentage runoff, Gatun Lake, year 1913.
104. Gatun Lake watershed. Mass curves of total yield, net yield, land area yield, storage, rainfall, and evaporation on lake surface.
105. Chagres River drainage basin. Mass curve of discharge at Alhajuela.
106. Chagres River drainage basin. Curve of discharge duration, Alhajuela.
107. Chagres River drainage basin. Curve of discharge duration for 24 years, Alhajuela.
108. Gatun Spillway. Changes due to operation of gates.
109. Gatun Spillway. Leakage of gates. December 23 to 25, 1913.
110. Gatun Spillway. Leakage of gates. March 12 to 14, 1914.
111. Miraflores Locks. Current observations taken below west lower operating gates.
112. Hydrographs showing surge in Culebra Cut at pontoon bridge on locking water at Pedro Miguel Lock.

APPENDIX B.

[Report of engineer of terminal construction.]

Plate.

20. Pacific terminals. Balboa Plain and Balboa Heights, looking northeast from top of Sosa Hill. July 1, 1914.
21. Balboa terminals. Pouring concrete in quay wall (g, h, i). November 26, 1913.
22. Balboa terminals. Looking from quay wall (g, h, i) along line of bulkhead wall of No. 1 slip, showing caissons sunk to rock and forms being started to receive superstructure. January 27, 1914.
23. Balboa terminals. Brick paving, east end of quay wall (g, h, i). March 18, 1914.
24. Balboa terminals. Interior of boiler shop. January 27, 1914.

Plate.

25. Balboa terminals. Condition of south wall of Dry Dock No. 1 after excavation by steam shovels to elevation —40. Slope taken is at natural dip of rock. June 26, 1914.
26. Balboa terminals. East end of north wall of Dry Dock No. 1, showing condition along incline. June 26, 1914.
27. Balboa terminals. Supporting runway piers for coal rehandling cranes over coal pocket. June 30, 1914.
28. Balboa terminals. Beam and floor reinforcement in superstructure on Pier No. 1. June 27, 1914.
29. Asphalt-concrete mixing plant at Balboa. June 27, 1914.
30. Making asphalt concrete roads at Balboa. June 27, 1914.
31. Cristobal coaling station, showing caissons in reloader foundations, looking south. May 26, 1914.
32. Cristobal coaling station, showing east bridge tract wall and south end of caissons under unloading wharf. Looking north. July 9, 1914.
33. East Breakwater, Limon Bay, Coco Solo storage yard, looking west from east end. August 12, 1914.
34. Toro Point Breakwater, top view, looking out. April 21, 1914.
35. Toro Point Breakwater, sea slope, looking out. April 21, 1914.

Following plates, 113 to 128, in portfolio.

113. Balboa shops and yards. General plan.
114. Dry Dock No. 1, Balboa. General plan and section.
115. Dry Dock No. 1, Balboa. Cross sections.
116. Balboa coaling plant. General plan.
117. Balboa coaling plant. Cross sections.
118. Balboa townsite. General plan.
119. Floating cranes *Ajax* and *Hercules*. Elevations.
120. Floating cranes *Ajax* and *Hercules*. Plan and sections.
121. Fuel-oil plant, Atlantic terminals. General plan.
122. Fuel-oil plant, Pacific terminals. General plan.
123. Cristobal coaling plant. General plan.
124. Cristobal coaling plant. Cross sections.
125. East Breakwater. General plan.
126. East Breakwater. Cross sections.
127. Type A tugs. Deck plans.
128. Type A tugs. Outboard profile.

APPENDIX C.

[Report of resident engineer, dredging division.]

Plate.

36. Culebra Cut, looking south from a point near present 1726. January 25, 1905.
37. Culebra Cut, between Gold and Contractors Hills, in 1890. Looking south.
38. Culebra Cut, between Gold and Contractors Hills, in 1890. Looking north.
39. Culebra Cut, looking north from Contractors Hill. December 28, 1907.
40. Culebra Cut, looking south from Contractors Hill (excavation completed south of Cucaracha slide). July 19, 1913.
41. Culebra Cut, looking south from Empire suspension bridge (lower shovels working on bottom of canal). June 16, 1913.
42. Culebra Cut, looking south from east bank half way between Culebra and Empire. June, 1913.

Plate.

43. Culebra Cut, Culebra. Looking north from east bank, showing bottom of canal. August 23, 1913.
44. Culebra Cut, Culebra. Looking south from east bank. Surface of water 72.3 feet above sea level. October 30, 1913.
45. Culebra Cut, Empire. Looking south from suspension bridge. Surface of water 72.3 feet above sea level. October 30, 1913.
46. Culebra Cut, looking north from one-fourth mile south of suspension bridge at Empire. Cut completed at bridge. June 16, 1913.
47. Culebra Cut, Empire. Looking south from west bank near Cunette. Surface of water 72.3 feet above sea level. October 30, 1913.
48. Culebra Cut, Empire. Looking south, showing suspension bridge. December, 1913.
49. Culebra Cut, Culebra. Looking south from Contractors Hill. Cucaracha slide in left center. May 25, 1913.
50. Culebra Cut, Culebra. Looking north. Lower part of Cucaracha slide on right. August 18, 1913.
51. Culebra Cut. Cucaracha slide, from west bank south of Contractors Hill. Looking north. October 16, 1913.
52. Culebra Cut, Culebra. Blasting a channel through Cucaracha slide. Looking north. October 16, 1913.
53. Culebra Cut, Culebra. Looking south from top of Contractors Hill. Cucaracha slide to left. December 3, 1913.
54. Culebra Cut, from Contractors Hill, showing ladder and dipper dredges working on toe of Cucaracha slide. December 9, 1913.
55. Culebra Cut, Culebra. Looking north from west bank. Dredges operating in Cucaracha slide. December 9, 1913.
56. Culebra Cut. Looking north from west bank. Width of channel at slide, 150 feet. December 18, 1913.
57. Culebra Cut, Culebra. Seagoing suction dredge *Culebra* passing Cucaracha slide. January 20, 1914.
58. Culebra Cut, Culebra. Looking north from Contractors Hill. June 12, 1914.
59. Culebra Cut, Culebra. Looking south from west bank, showing dredges working in Cucaracha slide. June, 1914.
60. Gamboa Dike. Opening the valves and flooding Culebra Cut. Water coming through four pipes. October 1, 1913.
61. Blowing up Gamboa Dike. Looking north from boat in canal south of dike. October 10, 1913.
62. Aids to navigation. Beacons in Culebra Cut.
63. Naos Island Breakwater. Looking south from Sosa Hill.
64. Paraiso pontoon bridge. Launching pontoon at Mount Hope shops. March 25, 1914.
65. Paraiso pontoon bridge. Looking north, showing train crossing canal. May 15, 1914.

Following plates, 129 to 135, in portfolio.

129. Prism at Cucaracha. October 20, 1913.
130. Prism at Cucaracha. February, 1914.
131. Prism at Cucaracha. June, 1914.
132. Cucaracha slide. January 14, 1914.
133. Cucaracha slide. February 28, 1914.
134. Cucaracha slide. April 9, 1914.
135. Cucaracha slide. May 8, 1914.

APPENDIX TO APPENDIX F.

[Report of resident engineer, permanent building division, supply department.]

Plate.

66. New administration building, Balboa Heights. North front.
67. New administration building, Balboa Heights. South front.
68. Completed four-family house in the new village of Balboa.
69. The new village of Balboa from the administration building.
70. The transmission line substation at Miraflores.

APPENDIX M.

[Charts showing organization of The Panama Canal and Panama Railroad Co., July, 1914.]

All plates in portfolio.

Plate.

137. General organization.
138. Executive department.
139. Engineer of maintenance.
140. Division of terminal construction.
141. Dredging division.
142. Mechanical division.
143. Division of canal transportation.
144. Supply department.
145. Accounting department.
146. Health department.
147. Washington office.
148. Panama Railroad.

ANNUAL REPORT
OF THE
ISTHMIAN CANAL COMMISSION
AND
THE PANAMA CANAL.

THE PANAMA CANAL,
OFFICE OF THE GOVERNOR,
Balboa Heights, Canal Zone, September 20, 1914.

SIR: I have the honor to submit the annual report covering the construction, operation, maintenance, sanitation, and protection of The Panama Canal for the fiscal year ended June 30, 1914.

ORGANIZATION.

The organization which existed at the close of the previous fiscal year and was described in the last annual report underwent a number of changes during the year, as the construction work was reduced and concentration of what remained seemed desirable and advantageous.

All municipal engineering work in the Canal Zone formerly performed by the construction divisions, as well as that performed in the cities of Colon and Panama by the division of public works, department of civil administration, was consolidated, effective July 16, 1913, forming the division of municipal engineering, under Mr. George M. Wells, resident engineer, reporting to the chief engineer.

For the design of the buildings for the new town of Balboa, an architectural force was organized on the Isthmus, as well as a force under a resident engineer for the erection of the new administration building and quarters for officers and employees, in accordance with plans which had been prepared and approved. In addition, a force under a landscape architect was gathered together to lay out the grounds and construct streets, water and sewer systems for the

Balboa town site, independent of the division of municipal engineering. While the work of the first two forces was directly under the supervision of the chief engineer, to reduce the cost of administration they were assigned to the quartermaster's department; the force of the landscape architect was placed under the second division of the chief engineer's office.

Effective October 1, 1913, the time keeping and cost keeping for the central division and the cost keeping for the quartermaster's department were transferred to the office of the chief engineer and consolidated with the forces already organized under this office to take care of the time keeping and cost keeping of other branches of the work.

With the admission of water into Culebra Cut by the blowing up of Gamboa Dike on October 10, 1913, the central division was abolished. The remaining dry excavation in the territory covered by this division was placed under a resident engineer reporting to the chief engineer; all surveying work and dredging were placed under the sixth division of the chief engineer's office, and the transportation forces, with those of the first, fifth, and fortification divisions, were concentrated under a superintendent of transportation and placed with the second division of the office of the chief engineer; the central division's property accountability was transferred to the quartermaster's department.

Effective October 15, 1913, the concrete work remaining to complete the construction of the locks at Gatun was transferred from the Atlantic division to the first division, which could do it in connection with installation of the machinery and towing tracks with the same supervisory force; similar unfinished work in connection with the Pacific Locks was also transferred to the first division at the same time.

On January 1, 1914, all dry excavation still in progress in connection with the Culebra Cut, the construction of the Naos Island Breakwater, the sluicing operations on the east bank of the Cut north of Gold Hill to relieve the pressure, and the fill of the town site at Balboa were consolidated and placed in charge of Mr. George A. Greenslade, general superintendent, and constituted the fourth division of the chief engineer's office. The auditing of property returns and the making of test checks of property were transferred from the chief quartermaster to the examiner of accounts.

The remaining work in the Atlantic and fifth divisions having reached such a stage as not to justify the administrative charges that the existing organizations called for, these two divisions were abolished on February 1. Their property accountability was transferred to the quartermaster's department and their records turned over to the fourth division, office of the chief engineer. The construc-

tion of the west breakwater and the operation of Porto Bello quarry were transferred to the second division of the chief engineer's office, while the work remaining at Gatun Dam, El Cano saddle, back fill at Miraflores, Miraflores spillway channel, Ancon quarry, and the sluicing at Gold Hill were placed directly under the chief engineer.

Effective April 1, 1914, by Executive order and in conformity with the Panama Canal act of August 24, 1912, the existing organization was abolished and the one contemplated by the act was made effective. Under this organizations there were created a department of operation and maintenance, a purchasing department, a supply department, an accounting department, a health department, an executive office, and a Washington office of The Panama Canal.

The department of operation and maintenance was placed in charge of the Governor and in the administration of the affairs of the department he is assisted by an engineer of maintenance and a superintendent of canal transportation. To provide for the remaining construction work as well as the maintenance and operation of the canal, the department was organized with the following divisions:

The division of terminal construction, which embraces charge of the design, inspection and construction of dry docks, shops, coaling and fuel-oil plants, floating cranes, docks, and other terminal facilities; construction transportation by rail; road, street, and sewer work in the new town of Balboa; and the breakwater construction at the Atlantic terminal, reporting to the Governor.

The division of erection; the electrical division; the division of municipal engineering; the division of lighthouses, until June 16, 1914, when it was abolished; and the office engineer with his forces, were placed under the engineer of maintenance.

The dredging division, fortification division, mechanical division, and the remaining construction work consisting of sluicing in the vicinity of Gold Hill, completion of Naos Island Breakwater, excavation in the dry to relieve side pressure in the vicinity of Culebra, and grading and filling at the locks and dams, combined in a general construction division, report directly to the Governor.

The division of canal transportation, under the supervision of a superintendent of transportation reporting to the Governor, is charged with the safe conduct of vessels through the canal. The port captains, the board of local inspectors, the pilots, and the admirers of vessels, and, since June 16, 1914, the care and operation of lights and beacons are directly in charge of the superintendent of transportation.

Col. H. F. Hodges, United States Army, was designated as engineer of maintenance, Mr. H. H. Rousseau, United States Navy, as engineer of terminal construction, and Capt. Hugh Rodman, United States Navy, as superintendent of transportation.

The quartermaster's department and the subsistence department, as outlined in previous annual reports, were consolidated to constitute the supply department, which was placed in charge of Capt. R. E. Wood as chief quartermaster. It has charge of the storing and distribution of all material and supplies for use of The Panama Canal and its employees, and for other departments on the Isthmus and their employees, and for vessels of the United States and other vessels when required. It operates commissaries, hotels, and messes; has charge of the maintenance of buildings, the assignment of quarters, and care of grounds. It recruits and distributes unskilled labor and is in charge of the necessary animal transportation.

The accounting department, as organized, consists of the auditor's, the paymaster's, and the collector's offices. The consolidation was made for administrative purposes only in order to secure economy, the auditor having supervision and direction of the entire department; the heads of the subdivisions, however, are independent in their own particular spheres. The department has charge of general bookkeeping, auditing, and accounting for both money and property, the examination of pay rolls and vouchers, the inspection of time books and of money and property accounts, the administrative examination of accounts as required by law, and the collection, custody, and disbursement of funds for The Panama Canal and the Canal Zone. The accounting department was placed in charge of Mr. H. A. A. Smith as auditor for The Panama Canal, with Mr. John H. McLean as paymaster and Mr. T. L. Clear as collector.

The health department was organized under the supervision and direction of a chief health officer, Lieut. Col. Charles F. Mason, United States Army. This department is charged with all matters relating to maritime sanitation and quarantine in the ports and waters of the Canal Zone and in the harbors of the cities of Panama and Colon, and with land sanitation in the Canal Zone and sanitary matters in the terminal cities in conformity with the canal treaty between the United States and the Republic of Panama, together with all matters relating to hospitals and charities.

The civil functions of the Canal Zone were placed in charge of an executive secretary who, under the direction of the Governor, has supervision of all matters relating to the keeping of the time of employees, to post offices, customs, taxes and excises, excepting the collection thereof, police and prisons, fire protection, land offices, schools, clubs, and law library, the custody of files and records, and the administration of estates of deceased and insane employees. He conducts all correspondence and communications between the authorities of the Canal Zone and the Government of the Republic of Panama, and the diplomatic representatives from other countries. Mr. C. A. McIlvaine was appointed executive secretary.

The scope of the work of the Washington office remained about the same as previously reported, Maj. F. C. Boggs, United States Army, being continued in charge as general purchasing officer and chief of office.

By Executive order of May 20, 1914, a committee of six members was created to arrange and provide suitable ceremonies for the formal and official opening of The Panama Canal, as is provided for in section 4 of the Panama Canal act. The committee is composed of persons who were members of the Isthmian Canal Commission and is to be known and referred to as the committee for the formal and official opening of the Panama Canal.

CONSTRUCTION.

PERSONNEL.

The central division, embracing the same work as described in the annual report for 1913, continued in charge of Lieut. Col. D. D. Gaillard, United States Army, as division engineer, until the division was abolished on October 15, 1913. During his absence on regular annual leave from May 7, 1913, to July 2, 1913, and during the part of his illness from July 29, 1913, to October 15, 1913, the work was conducted by Resident Engineer A. S. Zinn as acting division engineer. Subsequent to the abolition of the division and until January 1, 1914, Mr. Zinn continued in charge of steam-shovel work which was undertaken to lighten the banks, of the approaches to the pontoon bridge, and of the Naos Island Breakwater. Col. Gaillard died, as the result of a tumor on the brain, December 5, 1913.

The work of dry excavation in Culebra Cut was divided into two districts; one extended from Gamboa to Culebra, which continued in charge of Mr. J. M. Hagan, superintendent, until September 14, 1913, when he was transferred to Naos Island Breakwater, relieving Supt. W. T. Reynolds, who resigned on September 13, 1913. He remained in charge until the consolidation of the construction work under the fourth division, chief engineer's office, January 1, 1914. The breakwater was then placed under Mr. Will B. Casey, general foreman. The district from Culebra to Pedro Miguel Locks continued in charge of Mr. M. W. Tenny, superintendent, until December 31, 1913. The transportation division continued in charge of Mr. A. Sessions until he resigned, on October 13, 1913, when all the transportation on the Pacific side of the canal was concentrated.

The Atlantic division, embracing the same construction work as described in the last annual report, continued in charge of Lieut. Col. William L. Sibert, United States Army, as division engineer, until February 1, 1914, when the division was abolished. He continued on duty as a member of the Isthmian Canal Commission until

April 1, 1914. Maj. James P. Jervey, United States Army, resident engineer, continued in charge of the construction of the masonry work of the Gatun Locks until September 26, 1913. Maj. George M. Hoffman, United States Army, resident engineer, continued in charge of the Gatun Dam and spillway until September 28, 1913. On these dates both the latter officers were relieved on account of the practical completion of their work. Lieut. Col. William V. Judson, United States Army, assistant division engineer, continued in charge of the construction of the breakwater at Toro Point and the operation of the Porto Bello quarry until the abolition of the division, when he continued in charge of the same work as assistant division engineer until April 1, 1914, when, on his own request, he was relieved from duty with the canal.

The fifth division, chief engineer's office, continued in charge of Mr. H. O. Cole as resident engineer, and had charge of masonry construction of the Pacific locks, dams, and spillway, the operation of the Ancon quarry, and excavation of the channel between Pedro Miguel and Miraflores Locks until October 15, 1913, when the locks were transferred to the first division, and he continued in charge of the balance of the work until January 31, 1914, when the amount of work remaining necessitated a reorganization and he severed his connection with the canal.

Other officials connected with the work during the year are referred to elsewhere in the report.

LOCKS AND DAMS.

Gatun Locks.—As noted in the last annual report, the concrete work of the locks assigned to the Atlantic division was finished June 14, 1913, with the exception of the lamp-post bases, bases for snubbing buttons and mooring posts, stairway parapets, and the closing of openings left for construction purposes. During the year just ended there were laid 525 cubic yards of concrete in the locks structure at a division cost of \$95.2529 per cubic yard (including finishing and calking concrete previously laid); in the construction of the control house, 94 cubic yards at a division cost of \$81.2796 per cubic yard, and 9,785 cubic yards in connection with the installation of the machinery, at a division cost of \$10.7015 per cubic yard. The construction-plant mixers ceased operation on August 16, 1913. The construction cableways handled 4,111 cubic yards of concrete and were utilized for the transfer of material across the locks after the removal of the bridges used by the contractors in the erection of the gates. The amount of all concrete laid in the Gatun Locks, exclusive of that used in the construction of the control house, from the beginning of the work to the close of the fiscal year, aggregated 2,067,731 cubic yards at an average division cost of \$7.2122 per cubic yard. No rock or

sand was handled by the unloading cableways during the year, but they were used for transferring material from the stock piles to the tunnel hoppers and for unloading coal for use on the west side of the locks. The back filling of the side walls, made of material obtained from borrow pits, was continued until December 19, 1913, when the status of available money necessitated discontinuing further work. The amount placed during the year was 91,576 cubic yards at a division cost of \$1.4304 per cubic yard. The total amount of material used for back fill up to June 30, 1914, aggregated 2,119,406 cubic yards placed behind the side walls at a division cost of \$0.5007 per cubic yard, and a total of 113,163 cubic yards placed in the center wall at a division cost of \$0.7692 per cubic yard. Teams and scrapers, locomotive cranes, and hand labor were used to bring the back fill to final grade, at a cost for the year of \$47,376.79. To the end of the fiscal year a total of \$56,673.61 was expended on work for this final grading. The concrete paving of the slope between the locks and the Panama Railroad was completed during the year at a total cost of \$10,726.54. The lamp-posts, snubbing buttons, and mooring posts were completed in place. The construction of the control house, begun in April, 1913, was continued by the forces of the Atlantic division until October 15, 1913, when it was taken over by the first division with other unfinished work in the Atlantic division. It was completed by the close of the fiscal year, with the exception of the door and window frames. The amount expended for the construction of the building, which is of reinforced concrete, tile roof and tile floors, was \$54,391.60.

Gatun spillway.—Work on the spillway consisted in completing the fill of the openings of the valves in the body of the dam, raising the piers to full height, setting the valves, and completing the bridge. So far as the spillway proper is concerned, the structure was finally finished in October of 1913. During the year 7,047 cubic yards of concrete were laid, at an average cost of \$8.9005 per cubic yard, making the total amount of concrete placed in the structure 231,179 cubic yards, at an average cost of \$7.5273 per cubic yard. The steps on either side and the back fill in connection with them were completed by the supply department and finished in May, 1914.

Gatun Dam.—Work on the dam consisted in placing material on the portions east and west of the spillway to bring the dam to full height, in bringing the slopes generally to final grade, completing the fill around and over the core wall connecting the dam with the locks, paving the upstream slope, and in laying such permanent tracks as it was deemed advisable to maintain in order to make quick repairs in case of necessity. For this purpose two steam shovels were at work until March, 1914, borrowing material from north of the dam, principally red clay, and in accomplishing the grading and completion of the fill; 314,160 cubic yards were handled at a division

cost of \$0.4033 per cubic yard. Paving the upstream slope, as outlined in the last annual report, was completed in August, 1913, and 9,860 cubic yards of large riprap rock from Sosa Hill and from excavation for the dry dock at Balboa were used at a division cost of \$2.0403 per cubic yard in place. The total amount of large and crushed rock used for paving, therefore, was 94,330 cubic yards, and the average division cost was \$1.4378 per cubic yard. Permanent tracks aggregating 5,780 feet in length were laid with good rails and ties, with proper grades and curves. Observations for settlement were continued throughout the year. Seepage from the dam has been negligible. At the close of the rainy season two small streams were found issuing from the north toe in the west portion of the dam, but with the advance of the dry season these ceased entirely. There was no seepage of any kind apparent in the east portion of the dam.

Pedro Miguel Locks.—Masonry construction carried on at these locks by the fifth division consisted of lamp-post bases, bases for snubbing buttons and posts, stairway wells, and the control house. What remained after October 1, 1913, was taken over by the first division in connection with the concrete that was placed as an incident to the installation of the operating machinery. The amount of concrete laid in the lock structure was 1,087 cubic yards, at a division cost of \$22.3520 per cubic yard, including finishing and calking concrete previously laid; in the construction of the control house, 592 cubic yards, at a division cost of \$62.5423 per cubic yard, and 10,961 cubic yards in connection with the installation of machinery, at a division cost of \$11.1332 per cubic yard. As the machinery and wiring were not all installed, additional concrete will be required to complete the work. The total amount of concrete laid at the Pedro Miguel Locks (exclusive of that used in the construction of the control house) from the beginning of the work to the close of the fiscal year was 928,326 cubic yards, and the division cost was \$5.6575 per cubic yard. Work on the control house was begun in May, 1913, and was completed by the close of the year with the exception of the doors, windows, and plumbing. The amount expended on the construction of the building, which is of reinforced concrete, tile roof and tile floors, was \$68,521.95. The back filling of the side walls was completed in March, 1914, and the filling of the center wall in February, 1914. During the fiscal year 27,750 cubic yards of material were placed behind the side walls, at a division cost of \$1.1146 per cubic yard, and 5,619 cubic yards in the center wall, at a division cost of \$1.6139 per cubic yard. The total amount of material used for back fill up to June 30, 1914, aggregated 834,288 cubic yards placed behind the side walls, at a division cost of \$0.4131 per cubic yard and 220,768 cubic yards placed in the center wall, at a division cost of \$0.4777 per cubic yard.

Miraflores Locks.—At the close of the previous fiscal year the concrete of the locks proper was completed, except the lamp-post bases, bases for snubbing buttons and mooring posts, parapets around the stairways, and the nosing at the end of the south-approach pier. During the year just ended 2,844 cubic yards of concrete were laid in the locks structure at a division cost of \$20.6624 per cubic yard (including finishing and calking concrete previously laid); in the construction of the control house, 949 cubic yards at a division cost of \$57.2407 per cubic yard, and 18,241 cubic yards in connection with the installation of the machinery at a division cost of \$11.3685 per cubic yard. Additional concrete remained to be placed, as the installation of machinery and the wiring were not completed. The building of lamp-post bases on the southeast wing wall was interrupted by the necessity of transferring sand operations to Miraflores, and they remain to be placed. The amount of all concrete laid in the Miraflores Locks (exclusive of that used in the construction of the control house) from the beginning of the work to the close of the fiscal year was 1,507,794 cubic yards at a division cost of \$5.1695 per cubic yard.

The total amount of concrete laid in the Pacific Locks (exclusive of that used in the construction of the control houses) at the close of the fiscal year aggregated 2,436,120 cubic yards at an average division cost of \$5.3555 per cubic yard.

Backfilling the lock walls at Miraflores was continued, material for the west side being obtained from a borrow pit on the northwest side of Cocoli Hill and on the east side from the excavation of a channel for discharging the overflow from the spillway into the canal, from Diablo and Sosa Hills. The backfilling of the side walls was completed in May, 1914, and the filling of the center wall in March, 1914. During the fiscal year 360,198 cubic yards of material were placed behind the side walls at a division cost of \$0.6021 per cubic yard, and 92,244 cubic yards in the center wall at a division cost of \$0.5273 per cubic yard. The total amount of material used for back fill up to June 30, 1914, was 2,366,252 cubic yards placed behind the side walls at a division cost of \$0.3855 per cubic yard, and 249,457 cubic yards placed in the center wall at a division cost of \$0.5846 per cubic yard.

Miraflores Dam and spillway.—During the present fiscal year the total amount of concrete laid in the spillway was 10,112 cubic yards, of which 9,570 cubic yards were plain concrete at a division cost of \$8.3510 per cubic yard, and 542 cubic yards were reinforced concrete at a division cost of \$11.8730 per cubic yard. The total amount of concrete laid in the spillway to June 30, 1914, was 74,254 cubic yards at a division cost of \$6.2160 per cubic yard. The last concrete was laid in February, 1914. Dry filling on the west dam was completed

in February, 1914. During the year 98,424 cubic yards of material (secured from a borrow pit on the northwest side of Cocoli Hill) were placed in this dam at a division cost of \$0.6431 per cubic yard. The total amount of dry filling placed in the dam since the beginning of the work is 1,758,423 cubic yards, at a division cost of \$0.4582 per cubic yard.

The design, construction, and inspection of the lock gates, chain fenders, emergency dams, operating machinery, and electrical installations continued in charge of Col. H. F. Hodges, United States Army, as assistant chief engineer until April 1, 1914, and subsequently as engineer of maintenance.

Lock gates.—The construction and erection of the lock gates under contract were continued and completed in accordance with the supplemental articles of agreement entered into January 14, 1913. At Gatun all the gates for the west flight were completed on September 24, 1913; all the gates for the east flight on December 30, 1913. At Pedro Miguel all the gates for the east lock were completed September 30, 1913, and for the west lock on December 30, 1913. At Miraflores the gates for the west flight were completed on September 30, 1913, and for the east flight on January 10, 1914. All the gates were completed within the time specified in the supplemental contract, the time at Miraflores being anticipated by about two months. The original contract provided that the contractor should paint the gates with two coats of red lead, at his expense, and with a third coat of some other pigment to be furnished by the Isthmian Canal Commission, applied to the gates at the contractor's cost. To provide for more complete protection, this agreement was modified and at Gatun arrangement was made for an additional coat, making two of red lead and two others, instead of one. These additional coats consisted, one of United States Navy anticorrosive and one of antifouling paint, and were applied to those parts of the gates in the lower locks which are constantly under water. On the remaining gates at Gatun two coats of equal parts of graphite and red lead were applied. It was intended that no red lead should be used at Pedro Miguel except for the upper guard gates, the protection to consist of three coats of damp-proof paint. At Miraflores the gates in the lower lock from elevation —6 to the bottom were to be given two coats of red lead, followed by one coat of anticorrosive and one coat of antifouling paint. All the other gates were to be given three coats of a proprietary paint consisting of a hydrocarbon mixture. On account of delay in receipt of the damp-proof paints intended for use on the Pedro Miguel gates, some of these were painted with hydrocarbon paint from Miraflores and, conversely, a few of the Miraflores gates were painted with damp-proof paint. In all of these cases the third and fourth coats were applied by the Commission

forces. Due to impurities in the water of Gatun Lake, none of the paints, except the bitumastic which was applied directly to the metal on small sections of several of the gates at Gatun, has proved satisfactory, and the paint on those parts which are constantly under water is in very poor condition. The action of the gates in service is entirely satisfactory, the leakage at the quoin and miter posts being extremely small. The cost of the gates complete was \$6,471,806.99, of which \$5,632,942.38 were paid under the contract, and the balance of \$838,864.41 was for inspection, painting, recess covers, fixed steel, special tracks, and services furnished the contractor.

Gate machines.—All the parts for the mechanical and electrical installation of the machines for operating the miter gates were emplaced. The 40 machines required at Gatun were completed on February 28, 1914, the 24 machines at Pedro Miguel on March 28, 1914, and the 28 machines at Miraflores on May 28, 1914. A number of tests were conducted to determine the conditions under which the most satisfactory operation might be obtained, and the results obtained show the advisability of reducing the duty of the motor, which has very little reserve power, by starting one gate ahead of the other by an interval of approximately 20 seconds. The benefit derived results from the fact that, with only one gate operating, when the gates are near the mitering position the entire area of the chamber is available for the storage of water displaced. The cost of the miter-gate moving machines complete was \$822,410.03, of which \$704,744.78 were expended under the contract, and the balance for installation.

Miter-gate forcing machines.—With the material of the miter-gate forcing machines on hand, their erection progressed with the completion of the gates. The 20 machines required at Gatun were completed on February 14, 1914, the 12 at Pedro Miguel were completed on March 27, 1914, and the 14 at Miraflores on March 26, 1914. No special tests were conducted during the year. The total cost of the machines was \$57,200.16, of which \$40,225.88 were expended under the contract, and the balance for installation.

The machinery for operating the hand rails on the gates was installed complete during the year. There are 36 machines at Gatun, 20 at Pedro Miguel, and 24 at Miraflores. The operation is satisfactory, both on local and remote control circuits. The total amount expended was \$29,652.32, of which \$17,078.58 were paid out under the contract and the balance for installation.

The installation of the pumps for unwatering the gates was completed during the year. There are 40 pumps at Gatun, 24 at Pedro Miguel, and 28 at Miraflores. The total amount expended was \$28,516.31, of which \$18,979.98 were paid out under the contract and the balance for installation.

The installation of the electrical appliances for operating the various gate machines was completed during the year. The total amount expended was \$207,653.42, of which \$132,326 were paid out under the contract and the balance for installation.

Rising stem valves.—The placing of the valves, stems, roller trains, and crossheads remaining to be done at the close of the last fiscal year was completed and the 116 machines required for their operation were erected and the electrical installation completed. Of the machines placed during the year 5 were at Gatun and 28 at Miraflores, making a total of 56 at Gatun, 24 at Pedro Miguel, and 36 at Miraflores. The mechanical and electrical work in connection with the installation of these machines was completed at Gatun on February 12, 1914, at Pedro Miguel on March 30, 1914, and at Miraflores on March 30, 1914.

Guard valves.—At the end of the fiscal year all guard valves and machines were erected in place at all the locks except at Miraflores. The six at Gatun were completed on April 25, 1914, six at Pedro Miguel on June 29, 1914, and those at Miraflores were 62 per cent completed at the close of the fiscal year. The tests made of the guard valves showed that the machines would not operate satisfactorily as originally designed, and a number of changes were made necessary. The most important ones consisted in providing an outboard bearing to the pinion shaft, which overcame the tendency of the pinion to get out of line with the main spur gear, and guide shoes for weights in the counterweight pits to overcome the slight eccentric load due to the weight of the roller train.

The amount expended on the rising stem and guard valves and their machines to the close of the fiscal year was \$1,508,735.59, of which \$1,127,725.38 were paid under the contract and the balance for installation.

Auxiliary culvert valves.—The mechanical and electrical work in connection with the installation of these valves and their machines was completed during the year, four machines being installed at Gatun and completed on March 10, 1914, four at Pedro Miguel completed on March 5, 1914, and four at Miraflores completed on March 31, 1914. The cost of the machines in place was \$22,805.80, of which \$16,062.84 were paid under the contract and the balance for installation.

Cylindrical-valve machines.—The setting of all the cylindrical valves was completed during the previous fiscal year and 41.6 per cent of the electrical work had been finished. The total cost for the machines aggregated \$228,222.04, of which \$161,290.79 were in payment of contracts for furnishing material and the balance for installation. During the year the remaining electrical work was completed on the 60 at Gatun on March 30, 1914; on the 20 at Pedro

Miguel on January 27, 1914; and on the 40 at Miraflores on February 27, 1914.

Chain-fender machines.—After the tests had been completed on the two sample chain-fender machines, the results indicated that they would carry out the work for which they were designed and arrangements were made to order the balance of the equipment. Of the 16 to be erected at Gatun, the mechanical work on 14 was completed with the exception of the chains; of the 16 at Pedro Miguel, the mechanical work on 7 was completed with the exception of the chains; and at Miraflores, of the 16, the mechanical work on 1 was completed with the exception of the chains. Work was in progress on all the units, with the exception of the 4 lower ones at Miraflores, where no work had been done. The electrical work, so far as practicable, progressed with the mechanical work. The manufacture of chain for the fenders has progressed rather slowly, but orders were placed for all the chains required, with one exception, before the close of the year. The total amount expended thus far was \$830,726.89, of which \$661,140.30 was for payments under the contract for delivery of the material, and \$169,586.59 for erection.

The cost of inspecting the lock-operating machinery to June 30, 1914, was \$167,926.06.

Spillway gates.—The spillway gates were placed in position by the construction divisions in connection with building the spillway dams. The mechanical equipment and electrical installation were completed on the 14 machines at Gatun on December 18, 1913. At Miraflores the mechanical work was completed on the 8 machines on October 13, 1913, and the electrical work on June 5, 1914. The spillway gates at Gatun have all been operated satisfactorily under full head, controlled from a switchboard in the hydroelectric station. The tests of the Miraflores gates indicated defects in the mechanical work, necessitating overhauling and correction. These changes were not completed at the close of the fiscal year. The total amount expended was \$337,529.11, of which \$236,045.26 were expended under the contract, and the balance for inspection and erection.

Towing-track material.—All the towing-track material purchased under the original contract was delivered previous to June 30, 1913. During the year tests with the locomotives brought out the fact that it was necessary to provide additional rack sections at the top and bottom of all inclines at the locks, and 606 feet of additional rack sections were made at the Balboa shops. At Gatun Locks 1,182 linear feet of rack section were laid, 3,438 linear feet concreted in, and a total of 4,082 linear feet completed, making a total completed to date of 22,185 linear feet. At the Pedro Miguel Locks 1,518 linear feet of track were laid, 3,901 linear feet concreted in, making a total

of 13,696 linear feet completed to date. At Miraflores Locks 4,007 linear feet were laid, 8,160 feet concreted in, making 9,104 linear feet completed during the year, or a total to date of 18,144 linear feet. Of the total amount to be completed, 54,365 linear feet, 99.3 per cent were completed at the close of the year. Conductor-slot material, consisting of steel and copper conductor rails, insulators, brackets, and cover plates, was laid, and during the year 12,485 feet were completed, or a complete total to date at Gatun Locks of 45,084 linear feet; at Pedro Miguel 21,760 feet during the year, or a total to date of 36,292 linear feet; and at Miraflores 22,232 feet during the year, or a total to date of 28,162 linear feet. For the conductors copper tee rails were used for all towing tracks, inclines, and cross-overs, steel conductors being used on the return track. The installation of single and double crossovers and turnouts was completed during the year at all the locks. The total cost of all towing-track material installed was \$1,182,044.06, of which \$767,173.93 were expended under the original contract and \$414,870.13 for inspection, installation, and chipping of the rack rails.

Towing locomotives.—As noted in the last annual report, a contract was entered into with the General Electric Co. for furnishing 40 towing locomotives of their design and manufacture, the first locomotive to be delivered by January 15, 1914, and four locomotives each month thereafter. Twenty-one locomotives have been delivered and are in operation. The total cost under the contract is \$527,015 and there have been expended \$301,859.21 on the contract and \$22,329.40 for erection and alterations to the machines after their receipt. Tests so far made by actual service have not been sufficient to warrant an announcement that they are entirely satisfactory.

Illumination of the locks.—The exterior lighting of the locks was described in the previous annual report. The exterior lighting circuits at all the locks were completed except for five posts at Miraflores, where the erection of the posts has been delayed by the sand operations which were transferred to this point from Balboa to allow for the construction of the terminal docks. There were installed at Gatun 206 standards, 116 single arm and 90 double arm; at Pedro Miguel, 130 standards, 80 single arm and 50 double arm; at Miraflores, 163 standards, 96 single arm and 67 double arm. Suitable sockets, with lights, were installed for illuminating the operating tunnels and valve wells. The total amount expended to June 30, 1914, on the electrical lighting equipment of the locks was \$126,234.52.

Remote control.—The General Electric Co. was awarded the contract for furnishing the lock-control switchboards for Gatun, Pedro Miguel, and Miraflores Locks. The original specifications of the Commission were departed from as to the general construction of the board and also with regard to the method of accomplishing the re-

quired interlocking of the control switches. The detail design of the board was left entirely to the contractor, the work being subject to the approval of the Commission's inspector in the United States. The switchboards are located on the second floor of the control houses and the interlocking racks on the mezzanine floor. The boards are designed to represent the locks in miniature, all machines being represented by individual control switches, and wherever it is important for the operator to know the exact position of the machines being controlled indicators are provided which operate in synchronism with the machines in the lock wall tunnels. With the exception of the cylindrical valve, auxiliary culvert valve, and miter forcing machines the operator is provided with means for having definite information with regard to the exact position of the valve or machine being operated by means of synchronous indicators, electrically connected, with transmitting devices mechanically connected with the large machines in the lock tunnels. The operation of the cylindrical valve, auxiliary culvert valve, and miter forcing devices is indicated by use of red and green lamps on the control board. Arrangement is also made on the switchboard by which the water levels in the lock chambers are indicated to the operator. The control board was completed at Gatun on May 9, 1914; at Pedro Miguel on June 26, 1914; and at Miraflores on June 25, 1914. The switchboards of all the locks have been satisfactorily used for remote control of the lock operations. The total cost of all lock-control switchboards was \$108,079.50, of which \$73,693.33 were paid out under the contract for the material, the balance representing expenditures for installation and inspection.

Hydroelectric plant.—The erection of the hydroelectric station continued under the Atlantic division until September 8, 1913, when the work was transferred to the building division of the quartermaster's department. With the exception of the doors and some of the carpenter work, the building was completed at the close of the fiscal year at a total division cost of \$328,457.08. The installation of the equipment was continued during the year and was turned over to the operating force on June 18, 1914, without tests, which were made subsequently, and after correction of some of the defects the plant took over the load from the Gatun steam plant on July 13, 1914. The amount expended on the installation of the machinery was \$300,355.60.

In connection with the power-transmission system there were constructed underground duct lines from the hydroelectric power house at Gatun to the locks and to the transformer substation at the point, at a division cost of \$78,688.08; and from the Miraflores transformer substation to the Pedro Miguel and Miraflores Locks at a division cost of \$108,005.82.

As noted in the previous annual report, it was decided to install for the transmission line an overhead system of 44,000 volts, extending from Balboa to Cristobal, and connecting the existing Miraflores steam-power station with the Gatun hydroelectric station, so that they may be operated separately or in parallel as necessary. Four substations are provided, located at Cristobal, Gatun, Miraflores, and Balboa. The excavation for the Gatun substation was begun on November 26, 1913, and the steelwork, furnished and erected under contract, was completed on February 19, 1914. The installation of the electrical equipment of the building has been governed by the progress made in building construction and at the close of the year was 37 per cent completed. The total amount thus far expended on the building is \$145,717.92 and on the installation of the machinery \$40,818.11. The Cristobal substation was installed for the purpose of furnishing power required by the coal-handling plant, the Mount Hope pumping plant, and the miscellaneous requirements in the vicinity of Cristobal. Excavation for this structure was begun on March 4, 1914, and the erection of the steelwork under contract was completed on May 6, 1914. The amount expended on the building construction was \$111,858.01 and on the electrical installation \$8,557.96. The Miraflores substation is being installed for the purpose of caring for the power requirements of Miraflores and Pedro Miguel Locks, and also for the purpose of serving as a step up transformer station for Miraflores steam plant. The foundation work was commenced on October 29, 1913, and the steelwork under contract completed March 9, 1914. The electrical equipment is 22 per cent completed. The amount expended thus far is \$155,532.20, of which \$103,509.04 were for building construction and \$52,023.16 for electrical installation. The Balboa substation was located for the purpose of supplying power to Balboa shops, the air-compressor plant, dry-dock pumping plant, coal-handling plant, and Ancon pumping plant, as well as other local purposes. Work was begun on this substation on April 27, 1914, and the steelwork erected under contract was completed on June 27, 1914. Four per cent of the electrical equipment was installed. The total amount expended thus far is \$49,173.84, of which \$45,565.12 were for building construction and \$3,608.72 for electrical installation. In order to supply power to the power house of the Darien wireless station, being constructed by the canal authorities for the Navy Department, arrangements have been made to install a small substation of 400-kilowatt capacity, tapping the transmission line and stepping the voltage down to 440 volts. Change in the location of the pumping plant from Miraflores to Gamboa has necessitated the installation of a substation at this location. In order to supply the necessary power in connection with the pumping plant, arrangements were made for the installation of two

500-kilowatt power transformers and the necessary equipment for stepping the 44,000 volt transmission line pressure down to 2,200 volts.

High-power transmission line.—Under a contract dated March 31, 1913, 794 double-track span bridges and 20 single-track span bridges were to be delivered on the Isthmus. These have all been erected in place with the exception of five special towers which will be required at the Cristobal and Balboa terminals, and one bridge at Cristobal. Under contract there have been purchased and received to date for the transmission line 1,562,208 feet of 2/0 Brown & Sharpe gauge stranded copper and 512,065 feet of five-sixteenths inch copper-clad wire. At the close of the fiscal year 1,408,443 feet of 2/0 conductor cable were erected. The total amount expended on the transmission line was \$1,014,383.29, of which \$701,222.62 were covered by contracts and the balance expended on inspection and installation.

Cables.—The total amount of cable on order, received and installed up to the end of the fiscal year was 2,659,403 feet, of which 1,531,528 feet is lead sheathed and 1,127,875 feet is rubber covered, double-braid wire and cable. At the close of the fiscal year 1,462,684 feet of lead-covered cable had been pulled into the ducts and 911,816 feet of rubber covered had been used for the conductor slot feeds, control connections, etc.

Telephone system.—An elaborate system of telephone communication has been designed for the operation of the locks and a contract awarded for the complete equipment. It is to consist of three subdivisions: First, that required for the control of vessels passing through the locks; second, that required in the upkeep and maintenance work in the lock tunnels; and third, that required for local public service. The total amount of the contract is \$6,949.35.

Emergency dams.—The emergency dams at Gatun were completed before the close of the last fiscal year, but the final acceptance tests had not been finished. During the year the two dams at Gatun were accepted and the dams at Pedro Miguel and Miraflores were finished and accepted, the first at Pedro Miguel on September 16, 1913, and the second on October 17, 1913; at Miraflores the first was completed and accepted January 14, 1914, and the second on February 7, 1914. A test was made at Gatun in May, 1914; the dam was swung, girders and gates lowered, and the pipes driven to close the spaces between the ends of the gates. The upper lock was then filled with water to lake level, the upper guard gates and upper operating gates were opened, and the intermediate and lower gates of the lock closed. The upper lock was emptied through the culverts until the water level was below the guard-gate sill. This brought the full head of 47½ feet on the emergency dam, which was found to have a leakage

of 950 cubic feet per second. This leakage produced no dangerous current in the lock, and it would have been easy to close any of the lower gates in the face of the stream. Another purpose of the test was to determine whether the emergency dam could be used in lieu of a caisson for unwatering the locks so as to permit access to the gates for painting, but the leakage was too great to use the dam, as it at present stands, in lieu of the caisson. Experiments are being made to devise a means of stopping the flow. The total amount expended for the emergency dams was \$2,206,984.67, of which \$1,958,329.90 were covered by the contract for delivery of the material and its erection, and \$248,654.73 for inspection and other expenses assumed by The Panama Canal under the contract.

Floating caissons.—A description of the caissons for closing the entrance to the locks, including the pumping plant for unwatering the lock chambers, was given in the last annual report. Bids were invited on May 21, 1913, for furnishing the material, constructing and delivering the caisson on the Isthmus, and there were two bidders, the lowest bidder offering to construct the two caissons and deliver them at Balboa for the sum of \$648,300, and the price for one was given at \$330,760. A contract was entered into for one caisson under date of August 22, 1913.

Pontoon bridge.—In order to maintain communication across the canal with the west side, it was finally decided to construct a pontoon bridge at Paraiso for carrying the Panama Railroad. This bridge was constructed at the expense of the Panama Railroad Co., but the design and construction were undertaken by Commission forces. The approaches and abutments were built under the direction of Mr. A. S. Zinn, resident engineer; the pontoon and superstructure by the dredging division under Mr. W. G. Comber; the track work by the Panama Railroad Co., and the operating machinery by the first division of the chief engineer's office. The bridge revolves about a pivot at one point, similar to pontoon bridges successfully operated for many years on the upper Mississippi, plans for which were furnished through the courtesy of Mr. C. F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul Railway Co. The pontoon is 378 feet long over all, 55 feet wide, and 6 feet 3 inches deep at the center line. The base of the rail is 33 feet above the bottom of the barge, or 30 feet above the water level. The apron girders are 64 feet long, resting on hinged supports at both ends, and consist of spare lock gate parts. Arrangement is made at each end of the girder for automatically providing for a variation of 6 feet in the water level of the canal. When the bridge is turned the girders are lifted clear of the concrete piers by an electrically driven mechanism and temporarily supported by blocking on the ends of the barge. The bridge is revolved by means of a 1-inch anchor chain fastened at each bank, which passes

around an electrically driven wildcat on the deck of the pontoon, near the west end. The mechanism for lifting the apron girders and for turning the bridge, and also for operating the rail lift, the rail latches, and the main latch at the west pier, is operated from a central panel. The total cost of the bridge to June 30, 1914, was \$218,331.78.

Operation of locks.—The lockages made during the fiscal year gave an opportunity to try out the locks and their machinery. The first one at Gatun was made on September 26, 1913, when the tug *Gatun* was put through the Gatun Locks, followed on October 14, 1913, when a part of the dredging equipment was locked through the Pacific locks to the lake level. From these dates throughout the year various craft belonging to The Panama Canal were passed back and forth as the necessities of the work required, in addition to the tows that were instituted for handling freight from the Balboa terminals to Colon and Cristobal for the Panama Railroad Co. To try out the towing locomotives, the Panama Railroad steamers *Allianca* and *Ancon* were locked through Gatun Locks and returned, and through the courtesy of the agent of W. R. Grace & Co. the *Santa Clara* was locked through the Pacific Locks and returned.

The operation of the locks has developed certain facts in regard to the action of flowing water which had not been anticipated. As previously noted, the gates of the upper locks of each flight and of the Pedro Miguel Locks are duplicated. The upper pair of gates is called the guard gates and the lower pair of the upper two the lock gates. At the lower end of the locks the upper pair of gates is called the safety gates and the lower pair of the two the lock gates. The space between the guard gates and the lock gates is regulated by an auxiliary culvert, while the space between the safety gates and the lower gates is regulated by a T culvert. When the water in the upper lock is low and the valves are open there is a sudden drop of the water level in the forebay. This is more noticeable at Pedro Miguel, where the canal above the forebay is relatively narrow, than it is at Gatun and Miraflores, where the forebay opens immediately into the lake. This drop is faster than can be followed by the water in the space between the guard and upper gates, and the result is a reverse head on the guard gates, causing them to open at the miter. This reverse head lasts but a short time.

In the first lockages the T culvert regulating the space between the lower and safety gates was in free communication with the side wall culvert near its lower end, but above the lower valves. When the upper valves were raised the water in the space between these gates rose faster than in the lock; consequently there was a reverse pressure on the safety gates, causing them to open at the miter, the pressure being sufficiently great to compress fully the springs in the

gate-maneuvering struts. Due to the possible danger of crippling the moving apparatus by such reverse stress, the valves in the T culvert were partially closed, choking the communication between the side-wall culvert and the space between the gates. By experimenting, a degree of closure was reached which caused the water in the space between the culverts to lag behind the water in the lock when filling, and at the same time to fall rather more rapidly when emptying. In this way a positive pressure was always kept against the safety gates. With the use of both side and center wall culverts, as the rapidity with which the water level in the lock changes is greatly increased, a different adjustment will be necessary.

When the valves in the side culvert are raised and the water enters the lock the flow of water is greater through those openings in the laterals which are nearest the middle wall than through those nearer the side culvert. As the water rises in greatest volume next to the middle wall, there results a slight slope of the surface toward the side wall. When both side and middle culverts are used no such action is noticeable. The first gush of water from the side culverts appears to come from the highest laterals and then successively from the others. So far as can be ascertained, however, it can not be stated that the discharge is greatest from any one of the laterals.

In filling or emptying a small canal lock the water levels approach each other with a rapidity depending upon the square root of the diminishing head. Toward the end of the operation the change in level becomes slower, and the flow of water is supposed to cease either just before or at the equalization of the levels. Frequently the gates are opened with a very slight head against them to avoid the loss of time involved in waiting for the head to vanish entirely. In filling or emptying the locks of The Panama Canal there is a noticeable overtravel of the water, so that the water in the chamber which is filled rises slightly higher than the level in the chamber from which the water is drawn, and the gates separating the chambers become subjected to a reverse head. At Pedro Miguel it is noticed that the water rises from 0.3 to 0.6 of a foot higher than the water in the forebay, tending to throw the upper gates open. The difference in head is of short duration, but is very noticeable, and is taken as an indication of the instant when the apparatus for opening the gates should be put in motion. This acts as a safety device to the motors which operate the gates.

In the annual report of the Isthmian Canal Commission for 1911 is described the method used for overcoming differences in pressure on the lower gates at the lower lock at Miraflores and Gatun, due to the difference in density of the water above and below the gates, in consequence of which the culverts were turned up at the outer end so as to reduce the pressure to a manageable quantity. It is possible

that the overtravel of the water from the emptying lock into the tail bay may result in continuing the flow of the fresh water through the culvert beyond the point at which in theory it should cease and, therefore, in obviating the danger of the resultant pressure. However, no trouble is experienced from the resulting pressure against the lower gates. The difference in density of the water above and below the gates is, however, noticeable in another way. When the lower gates are opened the fresh water rushes out with considerable velocity on the surface of the salt water below, and there is a corresponding rush of salt water along the lower strata. This current continues for a considerable time and has a noticeable effect on vessels leaving the lock, sheering them away from the middle wall as soon as they pass the angle of the side wall.

The slope given to the water in the lock by use of the side culverts has already been noted. The same effect was noted during the filling of the lowest lock with fresh water when the lower gates have been left open long enough to insure salt water filling the lock. The slope is from the middle wall so that the ship moves to the side wall and the towing locomotives are unable to hold a large vessel central in the lower lock during the entire process of filling when the side culvert only is used.

As noted in previous annual reports, in the formula for filling and emptying the locks the coefficient of flow C , used to determine the real velocity, was assumed at 0.65, this being slightly more favorable than experience at other locks has shown to be readily obtainable, but the nature of design and construction warranted the assumption. From experiments made at Pedro Miguel when the lake level was at reference 84.8 and the water in the lock was at reference 50.9, the value of C for the side culvert, with both valves open, was determined to be 0.886, much more favorable than was anticipated. Similar observations, using only one valve, were made both at Pedro Miguel and in the upper lock at Gatun as a check, and the value of C was found to be 1.177 and 1.272 at the two locations, respectively. The value of the coefficient for emptying the lock at Pedro Miguel is somewhat less favorable than that for filling, the coefficient C for the side culvert being found to be 0.804 when both valves were used. At Gatun and Miraflores, where the culvert is turned up at the discharge, the coefficient of flow for emptying the lower lock is about 8 per cent less than through the level discharge at Pedro Miguel. When the middle wall culvert is used in combination with the side culvert the time of operation is greatly reduced. The Pedro Miguel Lock can be filled or emptied in about eight minutes without causing too great a disturbance in the chamber. Observations have not yet been made with the middle culverts at Gatun and Miraflores.

ELECTRICAL DIVISION.

The operation of the various power plants was consolidated on April 1 to comprise the electrical division, under Capt. W. H. Rose, United States Army. It includes the operation and maintenance of the steam-driven electric power plants at Gatun, Miraflores, Empire, and Balboa, and all the substations, transmission, and distribution lines connected with the power plants; the operation and maintenance of the air-compressor plants at Empire and Balboa; construction, operation, and maintenance of all building and street lighting systems in the Canal Zone; operation and maintenance of the electric cargo-handling cranes on the Panama Railroad pier at Balboa; the installation of all electrical equipment of the new Balboa shops of the mechanical division; and the construction of permanent underground conduit systems for the permanent towns of the Canal Zone.

One of the three 1,500 kilowatt vertical turbo generator sets and two 410 high-pressure water tube boilers were removed from the Gatun station for installation at the Miraflores power plant. The new unit was completed into place on June 1, 1914. This gives the Miraflores plant a capacity of about 6,000 kilowatts, the same as the hydro-electric station. The total amount of power in kilowatt hours generated during the year was:

6,824,556 kilowatt hours at Gatun, at a cost of \$0.0175 per kilowatt hour.
16,352.732 kilowatt hours at Miraflores, at a cost of \$0.0135 per kilowatt hour.

2,327,877 kilowatt hours at Empire, at a cost of \$0.0240 per kilowatt hour.
138,143 kilowatt hours at Balboa, at a cost of \$0.1503 per kilowatt hour.

The air-compressor plants operated during the year were at Empire and Balboa, and the Rio Grande plant was operated until November 1, 1913. They furnished compressed air for the excavation work at Culebra, Rio Grande, and Gold Hill; for the mechanical division shops at Empire, Balboa, and Paraiso; for the work of the division of erection at Pedro Miguel Locks, Ancon quarry, and for the work in the vicinity of Sosa Hill and the new dry dock at Balboa. The output of the air-compressor plants, in cubic feet of free air compressed to 105 pounds pressure, was 2,739,650,533 cubic feet at Balboa, at a cost of \$0.0484 per thousand feet; 2,908,900,165 cubic feet at Empire, at a cost of \$0.0351 per thousand feet; and 372,393,512 cubic feet at Rio Grande, at a cost of \$0.0282 per thousand feet.

The removal and reerection of wooden buildings from various points along the line to the Ancon-Balboa district necessitated the removal of the wires and fixtures, and later rewiring, of a total of 178 buildings. In February, 1914, two temporary substations were

completed, one at Miraflores and one at Balboa, each of 1,500 kilowatts capacity, for 11,000-volt transmission between these points. In May, 1914, another 11,000-volt transmission line was completed between Miraflores power plant and Cucaracha, supplying power to the relay pumps and the Gold Hill hydraulic plant. Additions and alterations necessitated a change in the pole lines for construction, amounting to about 15 miles. About 25 miles of pole line to supply power to the range lights and beacons of the lighthouse subdivision were constructed, the lighthouse subdivision erecting the poles and the electrical division installing the wires and transformers and making connections to the lights and beacons. Duplicate 2,200-volt armored cables, supplying power to Agua Clara pumping station, were installed between that station and the Gatun substation. In all about 12,900 feet of conduit, having 83,000 feet of duct incased in concrete, and 40 concrete manholes were completed during the year for connection between Pedro Miguel telephone exchange, Tivoli Hotel, the new administration building at Balboa, and the latter with the Balboa substation. A large amount of conduit work was done in connection with the electrical work in the permanent buildings and the Balboa shops. The eight 4-ton alternating current cargo-handling cranes, five 4-ton direct current cranes, and one 20-ton direct current French crane, all on the Panama Railroad pier at Balboa, were operated and maintained. These cranes handled practically all commercial freight crossing the Isthmus in either direction. The total number of vessels loaded and unloaded during the year was 413.

For further details concerning the various matters referred to above, attention is invited to Appendixes A and A-1.

MUNICIPAL ENGINEERING.

As already noted, the division of municipal engineering was formed by consolidating the division of public works and the municipal work in the three construction divisions on July 16, 1913, and was placed in charge of Mr. George M. Wells as resident engineer. The division is divided into five principal sections: The northern district embraces all municipal construction, maintenance, and operation work, exclusive of the operation of filtration plants, from and including Colon to Darien, a distance of 25.27 miles; the southern district embraces similar work from Darien to Balboa, including the city of Panama, a distance of 22.34 miles; the waterworks for the southern end of The Panama Canal embrace the construction of the purification works at Miraflores, pumping stations at Gamboa, Miraflores, and Ancon, reservoirs, and the laying of new mains; the fourth subdivision embraces the operation and care of purification plants and the care and

analyses of all Canal Zone water supplies; and the fifth subdivision embraces all work of design for the division.

The improvements in the city of Colon in progress at the close of the previous fiscal year and being paid for from an appropriation made by Congress of \$800,000, were completed in the early part of August, 1913, at a final cost of \$520,212.57.

The plant at Gatun for the manufacture of concrete pipe was operated until May, when the plant was closed down, there being sufficient on hand for all purposes. The usual maintenance work in connection with the reservoirs of the northern district was performed, and the level of the water in the Brazos Brook Reservoir was kept at about the same elevation during the dry season by letting water from Gatun Lake through the tunnel constructed during the previous year. The new purification plant located at Mount Hope and furnishing water to the city of Colon, Cristobal, and adjacent district was completed and placed in service in February, 1914, and has been successfully operated since that date. The total division cost of the plant was \$292,198.10.

In addition to maintenance work in the southern district, a considerable amount of construction work was undertaken, including streets, water and sewer systems, and roads in the new silver town of La Boca, storm sewers in the gold town site of Balboa, water and sewer systems and streets at Pedro Miguel, the installation of water and sewer systems for the Darien radio station, and work in connection with an addition to the city of Panama, for which the Republic of Panama made a special appropriation of \$76,000.

The question of providing a permanent, adequate, and suitable water supply for the towns of the Canal Zone from Pedro Miguel south has been under consideration for some time. The demands were greater than could be supplied by the Rio Grande Reservoir, and with the depopulation of the Canal Zone, which contemplated the elimination of all towns on the west side of the canal, a plan was prepared for utilizing Camacho and Rio Grande Reservoirs, connecting them by a pipe line, and increasing the capacity of the Rio Grande Reservoir by raising the dam, diverting the railroad for the purpose. With the adoption of the policy of quartering the troops on the west side of the canal, utilizing the old canal buildings for the purpose, together with the fact that the rainfall had not been sufficient to raise the level of the water in the reservoir to its full height, the whole subject was taken up anew in March, 1913. Five projects were presented, the cheapest of which contemplated the use of water from Miraflores Lake, and this was adopted. It contemplated the laying of the necessary mains, the construction of a purification plant of the rapid mechanical gravity type on Miraflores Hill, and the con-

struction of a high-service reservoir on the side of Ancon Hill, all to be based on a nominal maximum capacity of 12,000,000 gallons of filtered water per day. At the time that the use of Miraflores Lake water was considered, the possible objection was advanced that the chlorine content, by reason of the operation of Miraflores Locks, might increase beyond 75 to 100 parts per million, but at the time it did not seem possible that this would occur, at least for a period of years, on the assumption that intimate diffusion between the salt water admitted by the locks and the fresh water of the lake would not be rapid, more especially in view of the fact that water could be pumped from one of the fresh arms of the lake. At any rate, the enormous saving that would result seemed to warrant adopting the Miraflores Lake project.

In January, after the pumps from Cocoli had been transferred to Miraflores and increased in capacity to take care of the demand, chlorine sampling stations were established in the lake, and it was discovered that with the continued operation of the locks the chlorine content steadily rose. By February it became apparent that constant diffusion was taking place throughout all areas of the lake in general, as well as its arms, and went as high as 15 per cent salt water. In order to bring this down, a temporary pump station was installed at Pedro Miguel and approximately 4,000 gallons of water per minute were pumped from Culebra Cut north of the locks and discharged into Miraflores Lake immediately in front of the temporary pumping station. While this reduced the chlorine content of water going to Panama, it increased the turbidity of the water due to the condition in the Cut. As the result of these observations, it became evident that Miraflores Lake would be impracticable for use as a source of water supply for the southern end of the canal, and it was therefore decided to move the pumping station to the Chagres River at Gamboa, the water to be taken from this point through 30-inch to 36-inch cast-iron mains laid along the line of the Panama Railroad to the purification plant in course of erection on Miraflores Hill. Before final action was taken an effort was made to reduce the chlorine content by drawing off the water from Miraflores Lake through the locks and admitting fresh water through Pedro Miguel Locks, but the results were not satisfactory. Work was commenced on the purification plant located on Miraflores Hill on August 1 and steam-shovel and hand excavation was completed on January 28 by the removal of 91,233 cubic yards at a division cost of \$0.4933 per cubic yard. For the high-service reservoir at Ancon there were laid 1,477 cubic yards of reinforced concrete at a division cost of \$30.1455 per cubic yard, and in the purification plant on Miraflores Hill there were laid 5,656 cubic yards of reinforced concrete at a division cost of \$24.6506 per cubic yard. The total amount to be expended for the new water

works in the southern district was estimated at \$1,261,000, division cost; the total amount expended at the close of the fiscal year was \$703,585.05.

For further details attention is invited to Appendix A-2.

METEOROLOGY AND HYDROGRAPHY.

Until April 1, 1914, the meteorological and hydrographic sections continued under separate heads; on that date they were consolidated into one division under a chief hydrographer reporting to the engineer of maintenance, and a reduction of three gold men was effected.

But few changes were made during the year in the meteorological stations operated. Wind records were discontinued at Sosa Hill on January 1, 1914; the wind station was moved from Guarapo Island to the administration building at Gatun on December 14, 1913; and a new wind station was established at Gamboa on November 11, 1913. Evaporation records at Brazos Brook were discontinued on April 1, 1914. A rainfall station was established on the Siri branch of the Trinidad River in January, 1914, and a similar station was established near the head of the Gatun River branch of Gatun Lake in May, 1914. Records from these stations were obtained for use in estimating the monthly rainfall over the lake watershed. Seismic disturbances during the year were more numerous and severe than in any previous year since American occupation, 87 distinct shocks being recorded at Ancon. Practically all of the shocks seemed to originate in the vicinity of the lower coast of Los Santos Province, approximately 115 miles southwest of Ancon. The most violent shocks occurred on October 2, 1913, and May 28, 1914; in each instance a maximum amplitude of 75+ was recorded, when the recording pens were thrown off. The shock of May 28 resulted in slight damage to the new administration building then in course of erection at Balboa Heights, but with this exception the canal works suffered no damage from these shocks. For use of the Fortification Board, maximum and minimum temperatures were recorded on the Miraflores dumps. Duplicate automatic tide registers were continued at Balboa and Colon.

The main hydrographic features of the year were the filling of Gatun and Miraflores Lakes and the subsequent control of their water levels by means of spillway gates, auxiliary culvert valves, etc. The total yield of the Gatun Lake watershed for the calendar year 1913 was 77 per cent of the yearly mean since May, 1908, and 70.3 per cent of the mean for the 24-year period 1890-1913. There were no large freshets during the year.

The average temperature for the calendar year 1913 was slightly above normal. April was the warmest month at Ancon and Culebra and June was the warmest month at Colon. A temperature of 98° F.

recorded at Culebra on April 24 established a new high temperature record at that station.

The rainfall during 1913 was below normal at all stations except Brazos Brook, Colon, and Porto Bello. The heaviest precipitation for the year was 171.19 inches at Porto Bello, and the minimum was 59.54 inches at Balboa.

The wind movement over the Canal Zone for the year was slightly above normal. North and northwest winds prevailed. March was the windiest month at all stations, and November the month of least wind movement.

Between June 27 and December 27, 1913, the Gatun Lake level rose from plus 48.22 to plus 84.7. Since the latter date it has been controlled by the spillway gates between 85.14 and 84.13. During the year it was possible for the first time to determine the velocity which would be caused in the canal prism at Gamboa by floods in the upper Chagres. On May 26, with a discharge at Alhajuela of 16,000 feet per second, the velocity at Gamboa Bridge was 0.65 mile per hour, the lake level being at 84.92 and rising to 84.98. On June 30, with a discharge at Alhajuela of 20,050 feet per second, the velocity at Gamboa Bridge was 1.05 miles per hour, with the lake at 84.88 to 84.86.

For further particulars attention is invited to Appendix A-3.

GENERAL SURVEYS.

In addition to setting corner and grade stakes for building lots in Colon and Panama, setting grades for fill in Colon, making surveys and preparing maps of estates and parcels of land in dispute before the joint land commission, making surveys and inspections for the department of law, and performing a considerable amount of miscellaneous work, the general-surveys section repaired and removed certain Zone triangulation stations, made surveys and maps for other departments of The Panama Canal, made locations for the radio stations being constructed for the Navy Department, took readings on settlement hubs in the Gatun Dam, and performed the necessary work in connection with the precise level bench marks and monuments for the tide-guage registers at Colon, Gatun, and Miraflores.

AIDS TO NAVIGATION.

The construction and placing of lights and beacons was continued during the year and, with the exception of the light at the extremity of the west breakwater and the construction of six which can not be placed until the work in connection with the slides in Culebra Cut is completed, all the aids to navigation were finished and turned over to the superintendent of canal transportation, for maintenance and operation, on June 16, 1914. The design for the west breakwater

light was for rather an elaborate structure founded on a caisson which had been built during the previous fiscal year. During the year just ended it was taken to the site that it was to occupy and, in sinking it by admitting water through valves at the bottom of the caisson, the valves could not be controlled from above, it took a sheer, and the caisson sunk in a position which prevented its use for the purpose intended until it could be straightened. After expending \$8,602.22 in the attempt, it was abandoned as was also the design. The total amount expended in completing the entire system of beacons, lights, and buoys to date aggregate \$514,878.81, exclusive of general expenses.

For further details attention is invited to Appendix A.

DRY EXCAVATION.

The excavation for the canal prism in the dry, uncompleted at the close of the previous fiscal year, embraced the Culebra Cut from Gamboa to Pedro Miguel Locks, the channel between Pedro Miguel and Miraflores Locks, and the channel below Miraflores Locks to the dike which excluded the waters of the Pacific. As noted in the previous annual report, a decision had been reached to admit water to the Cut by blowing up the dike at Gamboa on October 10, 1913, and to complete the excavation that remained by dredges. With this end in view, the excavation in Culebra Cut was carried on during July with an average of 40.74 steam shovels, in August with an average of 34.65 steam shovels, and in September with an average of 14.62 steam shovels. These shovels worked not only in the Cut proper but on the upper reaches in the vicinity of Culebra and on the east side opposite Lirio. After the water had been admitted to the Cut from 5 to 2 shovels worked on both the east and west bank in the vicinity of Culebra so as to lighten the load. The work on the east bank was continued until April 1, 1914, and on the west bank intermittently until June 15, 1914. The last movement of any considerable amount occurred on the west side at Culebra just as the steam shovels were withdrawn. There were removed during the year a total of 3,122,702 cubic yards of material, of which 2,205,847 cubic yards were classified as rock, at a division cost of \$0.5661 per cubic yard. Due to large credits for material recovered after the completion of the work, such as rails, ties, etc., amounting to about \$260,000, the above figures do not represent the real cost of the work performed during the year which, eliminating these credits, was \$0.6492 per cubic yard. Work continued on Cucaracha slide, Culebra slides, Hagan's slide, Lirio slide, and the powder-house slide until steam-shovel operations were suspended and there were removed from these slides 2,635,902 cubic yards; in other words, 84 per cent of the material removed from the Cut was due to slides. The total amount of

material removed in the dry from Culebra Cut, from the beginning of American operations to June 15, 1914, aggregated 110,261,883 cubic yards at a division cost of \$0.7066 per cubic yard; of this amount 25,206,100 cubic yards were removed because of slides, or 22.86 per cent. This was an increase of 4,940,100 cubic yards over that estimated in the annual report for 1912. Steam-shovel operations in the Cut proper were permanently suspended on September 10, 1913, and at that time it was estimated that 600,000 cubic yards of material remained to be removed by dredges from the Cut section within the original limits of the canal, exclusive of slides and the inclines at the north and south ends of the Cut. Practically all of this material lay between Cucaracha slide and a point about midway between Culebra and Empire.

To prevent possible damage to the canal due to the velocity of current caused by the difference in head between Gatun Lake level and the bottom of the Cut, water was admitted through the 24-inch pipe extending into the lake under Gamboa Diike, these pipes remaining from the old pumping plant located in the vicinity to take care of the drainage water to the north of the divide. This was done at 9 a. m. on October 1. Work on drilling the dike at Gamboa preparatory to its demolition was begun in the latter part of August; the holes were loaded and were fired on October 10 at 2 p. m. In accordance with an arrangement made two or three days beforehand, the blast was fired by President Woodrow Wilson, at Washington. This was effected by using the land telegraph to Galveston, Tex., and connecting it there with the Central & South American Cable Co.'s submarine cable and land lines, which, by employing the company's transisthmian cable, furnished a connection to a local circuit in the vicinity of the dike. When the President depressed the lever, the current was relayed from point to point along the route and was eventually transmitted to the local circuit, closing it and tripping a weight attached to the handle of a switch. The weight threw the switch, setting off the blast. The result of the explosion was a clear opening 125 feet wide through which water from Gatun Lake flowed in sufficient volume to complete the filling of Culebra Cut from the dike to Cucaracha slide in about two hours' time. Prior to dynamiting the dike the water in the Cut was about 6 feet below the level of the lake.

On October 10, after the blowing up of Gamboa Diike, an effort was made to dynamite a passage through the Cucaracha slide in order to flood the Cut between the dike and Pedro Miguel Locks. Though steam shovels had been at work on the slide with a view to securing a passage through it, on the cessation of this work the movement continued and completely blocked the channel. The attempt to open a passage by dynamite was not successful, and it was not

until October 12 that a stream of water was gotten through and the area to the south of the slide began to fill. The dredges reached Cucaracha slide from the north end on October 20 and from the south end on October 24. The Gamboa Dike was attacked by dredges immediately after the explosion. A channel was finally dredged through Cucaracha slide, so as to permit the passage of the dredging fleet from one side to the other, on December 13. With the exception of a small pocket slide in the vicinity of Cascadas, the admission of water to the Cut has thus far had no bad effects; nor has there been any perceptible tendency for the presence of water to produce slides.

In the central division a total of 44.5 miles of track was removed during the period July 1 to October 10, a total of 33.7 miles were laid, and a total of 294.81 miles shifted.

The sluicing operations to the north of Gold Hill and to the rear of Cucaracha slide were continued during the year and resulted in the removal of 1,384,455 cubic yards of rock and earth, at an average division cost of \$0.1997 per cubic yard. This material was carried by flumes into the valley to the east of the canal.

Material removed in the dry from Culebra Cut was wasted at different localities, the bulk of it going to Balboa waste dumps, where 1,017,596 cubic yards were deposited, and on the dumps along the relocation of the Panama Railroad, where 920,748 cubic yards were placed. The balance was used largely in fills at various points south of the Cut.

South of Pedro Miguel Locks material amounting to 306,700 cubic yards was excavated by the fifth division. Of this, 20,510 cubic yards were from the channel south of Pedro Miguel Locks and 286,190 cubic yards from the prism south of the Miraflores Locks. The average division cost was \$0.5134 per cubic yard. The material was used as a back fill to the locks and for sloping the Miraflores Dam.

On account of material recovered at the close of the work, credit was given aggregating about \$79,000, so that the actual cost of dry excavation during the year was \$0.7709 per cubic yard. The total amount excavated in the dry from Pedro Miguel to the sea since the beginning of the work aggregated 4,819,969 cubic yards, at a division cost of \$0.6755.

The berm and chamber cranes on the west side of the locks were taken down and stored; the four berm cranes, which formed a part of the concrete-handling plant during the construction of the Pacific locks, will be used in connection with the coal-handling plant at Balboa.

Steam-shovel work south of Pedro Miguel Locks was stopped in August and south of Miraflores Locks in September, and steps taken to remove all tracks that remained within the limits of the canal

channel. The last remaining barrier at the Pacific end of the canal was dynamited at 9.30 o'clock August 31, 1913. This dike, composed of a trestle fill of rock and earth, prevented the water from the sea level from entering the steam-shovel cut, 5,000 feet long, 500 feet wide, and 46 feet below mean tide, extending to Miraflores Locks. The Rio Grande diversion was turned into this pit on August 23, but the depth of water had only reached about 15 feet by August 31. About 37,000 pounds of 45 per cent and 60 per cent dynamite were used, the charge being placed in 541 holes at an average depth of 30 feet. At the time of the explosion the water in the channel south of the barrier was nearly at low tide. The dynamite tore a gap in the dike about 100 feet wide, but as the bottom of the gap was still at some height above the existing tide level, no water passed through until high tide, at 1.35 p. m. At 3 o'clock, 1 hour and 25 minutes after the water first began to flow over, the level in the inside channel was that of the outside channel, while the gap had been widened to 400 feet or more.

As noted in previous annual reports, there were two low places in the perimeter of Gatun Lake which were to be raised in order to avoid all possibility of the waters of the lake escaping. One of these was in the vicinity of Gatun, and an embankment was built across it by the forces of the Atlantic division. This was in a ravine at the headwaters of Las Guachas Creek, where the natural elevation was 85.7 feet above sea level. A fill about 350 feet long and containing approximately 4,117 cubic yards was made by means of mule-team scrapers, borrowing from adjacent hills, which raised the surface to elevation 105, with a crown width of 15 feet. Under date of November 28, 1913, a contract was made for building an earth dike at Cano Saddle No. 4, along a ridge about 12 miles southwest of Gatun, to raise the rim of Gatun Lake at that point to 105 feet above sea level. The estimated amount of material involved was 71,500 cubic yards, and the contract price was 68 cents per cubic yard, embankment measure. The work was completed in May, 1914. The payments to contractor will aggregate \$48,950.50. This saddle is between the headwaters of the Siri River, a tributary of the Trinidad, and the Lagarto River, which flows into the Caribbean Sea. The surface of the earth at the lowest point was 87.4 feet above sea level. The fill is approximately 900 feet long between the 105-foot contours on knolls at the ends of the saddle. It is 15 feet at the top, with a slope of 1 on 3 on both sides.

DREDGING.

The dredging division continued in charge of Mr. W. G. Comber as resident engineer, and was subdivided into two districts, the first extending from deep water in the Pacific to Gamboa, and the second from Gamboa to deep water in the Caribbean.

In the first district, between Pedro Miguel Locks and the sea, there were removed 5,364,816 cubic yards, of which 3,329,072 cubic yards were taken from within the canal prism and the balance was auxiliary work. Of the amount removed from within the canal prism, 1,186,432 cubic yards were of rock. Of the rock excavated, 146,477 cubic yards were drilled and blasted by the drill barge *Teredo* and 60,832 cubic yards were broken by the rock breaker *Vulcan*. The remainder includes rock which had been drilled by well drills and blasted in previous years and material which could be handled by the dredges without mining. The average cost of prism excavation was \$0.2578 per cubic yard. Active operations began in Culebra Cut on October 23, 1913, and continued throughout the year; a total of 3,432,363 cubic yards were removed, of which 919,655 cubic yards were of earth and the balance rock. The average cost was \$0.5194 per cubic yard. Of this amount, 865,015 cubic yards of earth and 1,557,360 cubic yards of rock were removed from Cucaracha slide, at an average cost of \$0.4730 per cubic yard. Pipe-line dredges, with the assistance of a relay, pumped over the west bank of the canal into the Rio Grande Valley 684,514 cubic yards of earth and 77,880 cubic yards of rock, at an average cost of \$0.2773 per cubic yard. Cucaracha slide has been very active since dredging operations started, the daily movement averaging about $2\frac{1}{2}$ feet. On June 30, 1914, the total area of the slide was 60.4 acres, 44.6 acres active and 15.8 acres without motion. Dredging was done during four months of the year in Miraflores Lake, removing 159,817 cubic yards of earth from the canal prism, at an average cost of \$0.3179 per cubic yard.

In the second district 6,544,192 cubic yards were removed during the year, of which 3,692,576 cubic yards were removed from within the canal prism, 574,630 cubic yards from old French dump in Limon Bay, and the balance was auxiliary work. The average cost of prism and French dump dredging was \$0.1717 per cubic yard. Of the amount removed from the canal prism, 158,994 cubic yards were of rock. Of the total amount taken out, there were removed between October, 1913, and February, 1914, 507,195 cubic yards of earth and 5,035 cubic yards of rock from the canal prism just north of Gamboa, from what was formerly known as Point No. 1.

In connection with the Atlantic terminals the dredges removed 18,286 cubic yards of earth and 16,015 cubic yards of rock from the site of the bridge crossing the French canal south of the dry dock, 117,289 cubic yards of earth from the approach channel, 275,993 cubic yards of earth and 46,360 cubic yards of rock from the new Piers Nos. 7, 8, and 9, and 181,709 cubic yards of earth and 213,325 cubic yards of rock from the coaling station. The average cost of excavation at these terminals was \$0.3646 per cubic yard. Seventeen

thousand cubic yards were placed in the fill for the substation and 304,411 cubic yards were placed in fills for bridge foundations, coal basins, and yards at the coaling station.

At the Pacific terminals the dredges removed 1,919,003 cubic yards of earth and 7,964 cubic yards of rock, of which 1,831,711 cubic yards of earth were handled by pipe-line dredges and relays and placed in fills for reclaiming swamp land. The average cost of this work was \$0.1655 per cubic yard.

A considerable amount of miscellaneous dredging was also done, making the total removed by the entire dredging fleet, including yardage of sand and gravel reclaimed, 15,341,371 cubic yards. The fleet consisted of the seagoing suction dredges *Caribbean* and *Culebra*, the seagoing ladder dredge *Corozal*, the French ladder dredges *Badger, No. 1, No. 5, Gopher, Marmot*, and *Mole* (the last abandoned as worn out on September 20, 1913), the 5-yard dipper dredges *Cardenas, Chagres*, and *Mindi*, the 15-yard dipper dredges *Gamboa* and *Paraiso*, and the pipe-line suction dredges *No. 4, No. 82, No. 83, No. 85, No. 86*, and the *Sandpiper*. In connection with these dredges there were employed 12 tugs, 19 launches, 9 clapnets, and 24 dump scows.

As noted in the previous annual report, a contract was made with the Bucyrus Co. for the construction of two 15-yard dipper dredges and their delivery at tidewater in the United States. The first was to be ready for towing to the Isthmus on December 1, 1913, and the second on January 1, 1914. The first dredge was accepted at Port Richmond, N. Y., on February 16, reached the Isthmus on March 16, and was placed in operation on April 4, 1914. The second dredge was accepted at Port Richmond on April 13, reached the Isthmus on May 22, and went into commission at Cucaracha slide on June 7, 1914. Due to a failure of the buckets, which were not sufficiently strong to do the work, an additional delay was caused. The failure to meet the stipulated dates of delivery resulted in very seriously handicapping the work at Cucaracha slide and delayed securing a channel sufficiently deep and wide to permit the canal to be utilized for the passage of commerce before the close of the year.

The sum of \$2,000 was authorized to be expended in the construction of temporary dikes on the west side of the channel where it is cut through at the head of Limon Bay, to determine the effect upon erosion that was occurring, due to the waves created by the trade winds. The results were so satisfactory that it has been decided to make these dikes permanent.

For further particulars, attention is invited to Appendix C.

MECHANICAL DIVISION.

The mechanical division was in charge of Mr. A. L. Robinson until July 19, 1913, when he resigned from the service. Subsequent to that date and until March 6, 1914, Lieut. Col. T. C. Dickson, United States Army, performed the general duties relating to organization and personnel, while the operation of the shops was under the supervision of Mr. John J. Eason as assistant superintendent. On January 26, 1914, Mr. D. C. Nutting, United States Navy, reporting for duty, was assigned as superintendent and took over all the duties performed by Col. Dickson in connection with this division.

The establishments under operation by the division consisted of the Balboa shops (including roundhouse and car shops), the Cristobal shops and dry dock, Paraiso shops, Cristobal roundhouse, the small hoisting establishments at Gatun, Empire, and Paraiso, and the car-inspecting establishments at Cristobal and Balboa.

The Cristobal shops and dry dock have been charged with all repairs to floating equipment; as this dock was the only one available when a dry dock was necessary, it was in practically continuous use throughout the year. For the purpose of docking the five submarines which are on duty on the Isthmus and for docking the *Corozal* the upper lock of the east flight at Gatun was used. The Paraiso shops were reestablished on October 22, 1913, to take care of repair work on the dredging equipment operating in Culebra Cut. The hostling of four engines operating in this vicinity was turned over to these shops on May 25, 1914, and is performed under the foreman machinist. The Cristobal roundhouse was turned over to the mechanical division on April 1, 1914, and all hostling at the north end of the canal was concentrated there. The establishment, in addition to the roundhouse, comprises a small boiler plant and two air compressors with a combined capacity of about 2,000 feet per minute. The plant supplies air for hostling purposes and also for work on the new piers of the Panama Railroad. A small hostling plant was established at Empire, in the shops vacated, March 1. With the establishment of the electrical division on April 1, 1914, the electrical plants at Empire, Miraflores, Gatun, and Balboa, previously operated by the mechanical division, were turned over to that division and, as these plants contained air compressors, the air compressors were likewise turned over to the electrical division. The old shipways shops at the Pacific entrance, formerly occupied by the dredging division, were turned over to the mechanical division on October 22, 1913, and so continued until they were torn down in March and April. The machine shops and engine house at Gatun were operated for work in connection with the installation of lock ma-

chinery and caring for locomotives engaged in that vicinity. They were abandoned April 1, 1914, and the work transferred to Balboa and Cristobal. The Pedro Miguel engine house was abandoned on September 15, 1913, and the greater portion of the equipment moved to the Gold Hill engine house and the buildings turned over to the quartermaster's department and torn down. An engine house was established at Gold Hill in September, 1913, to care for the equipment employed in dry excavation north of Gold Hill. The engine house continued in operation until completion of the excavation work and was discontinued on March 31, 1914. The air-compressor plant at Rio Grande, which had been in operation since 1905, was shut down on October 15, 1913, and such compressed air as was required in the district previously supplied by Rio Grande was furnished by the plant at Empire. The Cristobal car shops were in operation until March 7, 1914, when they were abandoned and all car work concentrated at the Balboa shops. When the Balboa roundhouse was put into service on April 1, 1914, the Panama roundhouse of the Panama Railroad was placed out of use.

Throughout the year, while the shops were in operation, two shifts were regularly worked at Gorgona, Empire, Paraiso, and Balboa. In addition to the double shift, emergencies continually arose which necessitated large amounts of overtime work, in order that equipment might be kept in condition for use and to prevent delay in the work of other divisions.

For further details, as well as a statement showing the amount of work done during the year by the various shops, attention is invited to Appendix D.

DIVISION OF TERMINALS.

The division of terminal construction was organized on April 1, 1914, under Mr. H. H. Rousseau, United States Navy, as engineer of terminal construction. The division embraces the forces of the former second division, chief engineer's office engaged in the design, inspection and construction of the dry docks, shops, coal and fuel-oil plants, floating cranes, docks and other terminal facilities; construction transportation by rail; the road, street and sewer work under the landscape architect; and the breakwater construction at the Atlantic terminal.

Dry docks.—The general description and principal dimensions of Dry Docks No. 1 and No. 2, at Balboa, were given in the previous annual report. On account of the condition of funds, it was decided to defer the construction of Dry Dock No. 2, but such of the dock structure as serves as an entrance pier for Dry Dock No. 1, and as will permit the future completion of Dry Dock No. 2 in the dry without especial increase in cost will be built now. The cofferdam,

which was begun on April 1, 1913, to protect the entrance of Dry Dock No. 1, Dry Dock No. 2, the entrance basin, and coal-pocket excavations, was completed by placing 103,116 cubic yards of material. Difficulty was experienced through a portion of the double-track trestle giving way and moving outward after dumping from it had commenced, but this was overcome by reinforcing the outer toe by dumping material from barges and the cofferdam was completed. The leakage through it is relatively small and can be controlled by pumps. In excavating for Dry Dock No. 1 and Dry Dock No. 2, the coal pockets and entrance basin, the old Balboa machine shops forced the work to be confined to the center and south sides until November, when they were demolished and the last obstacle to excavation was removed. The total amount taken out from the site of Dry Dock No. 1 during the year was 358,282 cubic yards, 48,838 cubic yards of which were classified as earth and the balance as rock, making a total of 466,975 cubic yards excavated from this area up to the close of the year. The division cost for the year was \$1.0250 per cubic yard, and the average division cost of the total was \$0.9946 per cubic yard. From the site of Dry Dock No. 2, which is located just north of the entrance of Dry Dock No. 1, there were removed during the year 41,548 cubic yards of earth and 52,129 cubic yards of rock, at an average division cost of \$0.8129 per cubic yard. Steam-shovel operations deepened the excavation from -13.5 to the final grade for the entire area of the approach basin inside of the cofferdam, and a total of 351,333 cubic yards were removed at a division cost of \$1.0250 per cubic yard. The area required for the storage of coal and for the travel of unloading towers measures 800 feet in length and about 400 feet in width, measured from the outer edge of the quay wall. The total amount of excavation during the year was 166,104 cubic yards, 79,837 cubic yards of which were earth and the balance rock. The average division cost was \$0.7984 per cubic yard. The material excavated from the site of the dry docks, entrance basin, and coal pocket was removed by means of steam shovels, three of which were worked 8 hours a day until February, 1914, when on the 5th of that month the shovels were placed on a 12-hour basis and another shovel added. These shovels worked on split shifts, 12 hours a day, continuously to the end of the year; one shovel was removed in June. The contract entered into October 12, 1912, for one pair of steel miter-gate leaves and fixed irons was completed during the fiscal year, and the material is stored on the Isthmus awaiting erection. The moving machines for operating the leaves, together with motors, controls, and covers, are also delivered.

Balboa coaling station.—Upon completion of the excavation for the coaling plant, work was begun on masonry for the crane runway supports, which extend east and west through the center of the

storage pile, and will support the old Pacific division berm cranes which will be reerected to rehandle the coal. The material was mixed by a $\frac{1}{2}$ -yard mixer and placed by a locomotive crane. At the close of the fiscal year all but three of the piers over the deep coal pockets were up to the construction joint, where the girders which carry the rail are to be set. The retaining wall between the high and low storage pockets was up to elevation 12 for three-fourths of its length. The rubble retaining wall on the south side of the low storage area was completed, as well as a part of the small rubble retaining wall at the east end of the high area. There were placed during the year 1,330 cubic yards of concrete and 808 cubic yards of rubble masonry at an average division cost of \$7.4811 per cubic yard. There were also placed in the foundations for the berm cranes 2,620 cubic yards of concrete at a division cost, exclusive of reinforcements, of \$7.4464 per cubic yard.

The total amount of excavation accomplished, including the work for dry docks, entrance basin, coaling plant, shops, quay walls, and piers, aggregated 1,513,048 cubic yards, of which 1,477,843 cubic yards were placed in fills and embankments, the remainder being hand excavation wasted in the excavation of foundations for shops, and orange-peel excavation thrown to one side during the excavation for foundations for wharves and piers. The excavated material was used to bring the shops' yard up to elevation 18 to make the fill behind the quay wall, piers, and the area to be occupied by the Panama Railroad yards, which lie east of the head wall of the permanent piers, for the Naos Island Breakwater, and part was wasted on the Balboa dumps.

Shops.—Lieut. Col. T. C. Dickson, United States Army, inspector of shops, was in immediate charge of the design and installation of the machinery of the new Balboa shops until March 6, 1914, when he was relieved from duty with the canal. The steelwork was carried on by contract and completed during the year. The total amount of material delivered was 11,657,429 pounds, and the cost of the material and erection in place under contract was \$427,203. The work was completed. The buildings have cement tile roofing, the tiles being manufactured on the Isthmus and erected in place under contract; the total amount of standard red tile squares put on was 6,441.18; gutter-tile squares, 201.15; ridge roll, 7,351 linear feet; ribbed glass pieces, 11,188; and the total cost was \$102,659.98. The remaining work on the foundations was pushed so as to be prepared for the contractor for the steelwork, and 3,221 cubic yards of concrete were placed during the year. All the shop area had been brought up to grade and surfaced with crushed stone, excepting the space occupied by the incline from the dry-dock excavation and a small area between the roundhouse yard and the foundry. The

foundations of two of the buildings were interfered with by the sand dock and considerable trouble was experienced in placing foundations, due to obstructions in the mud below low tide, consisting of old barges and other French equipment and old metal which had been dumped into the area and subsequently covered up.

The installation of machine foundations in the various buildings progressed rapidly as soon as it was possible to start work inside the buildings. In this connection 4,944 cubic yards of concrete were used. The shops' tunnel, which runs through the building and yard parallel to the axis of the dry dock, was completed. A proper drainage system was provided over the entire area.

The mechanical division abandoned Gorgona in August, 1913, and, together with the foundry and planing mill, moved direct to Balboa. The other shops were transferred temporarily to Empire, and, commencing March 1, 1914, were gradually moved to Balboa. At the close of the year practically all of the machines were erected in the permanent locations and in operation. The total amount expended on the shops, including the cost of moving and installing the machines, was \$2,384,967.33. The shops office building is the last one under construction. At the close of the year the steel framework and cement tile roofing were completed and the construction division of the supply department was putting in the walls and floors, and engaged in the completion of the building. The total amount expended on the office building was \$59,494.90.

Breakwaters.—As stated in the last annual report, it was decided to construct a detached breakwater on the east side of Colon Harbor to protect the interior harbor against the waves caused by the trade winds, its general direction extending out from Coco Solo to a point 2,000 feet east of the outer extremity of the west breakwater. The breakwater, as originally approved, was to be 7,200 feet long, its inner end being 3,893 feet from the end of the shore fill. Investigations were made in various localities for the purpose of securing suitable core and armor rock for use in its construction, with a view to doing away with the necessity of the further use of Porto Bello. Upon the examination of comparative estimates of costs bearing on different sources of supply of rock to be used, it was decided to obtain the rock from the Sosa Hill quarry and transport it across the Isthmus. A double-track trestle was extended out from Coco Solo and about 11,093 linear feet were completed at the close of the year. A railroad connection was completed between the root of the breakwater and the railroad extending from Mount Hope to Margarita Point. Auxiliary lines and sidings were built in the vicinity of Coco Solo Point and along the Margarita Point railroad. In all 5.2 miles of new track were laid. A dock 16 by 100 feet, with trestle and track connections, was built for the unloading of materials, and a small

harbor for the landing of launches and tugs towing piles was excavated by the dredge *Sandpiper*, necessitating the removal of 58,650 cubic yards of sand. A 6-inch water main was laid from the Margarita Point main at the Coco Solo turnout, and a 50,000-gallon storage tank was erected for watering locomotives and for additional fire protection. The Coco Solo yard was filled in to elevation plus 3.3, and the approach tracks for the trestle were raised to elevation plus 14.5. Practically all of the tracks have been ballasted to the main line of the Panama Railroad, for which 64,506 cubic yards of fill were used in addition to 11,512 cubic yards of gravel ballast and 522 cubic yards of crushed-rock ballast.

With the abolition of the Atlantic division on February 1, the west breakwater work in Colon Harbor and the operation of Porto Bello quarry were transferred to the division of terminal construction. Armor rock was procured from Porto Bello on the old crushed-rock quarry level above the two lower levels referred to in the last annual report. On December 1, 1913, the working hours in the quarry were reduced from 12 hours to 8 hours a day, and on April 30 the operation of the quarry ceased. During the year 207,654 cubic yards of armor rock were produced and shipped at a division cost of \$4.0182 per cubic yard. Auxiliary excavation by steam shovels amounted to 302,893 cubic yards, which were wasted on the shore dump. In May, 1914, the quarry was closed down in such a manner that it can be reopened if found necessary later in connection with the east breakwater. Of the 207,654 cubic yards of rock shipped from Porto Bello, 162,951 cubic yards were placed by three derrick barges and 44,703 cubic yards were placed by three cranes at a division cost of \$0.9673 per cubic yard. Rock removed by dredges to the extent of 18,254 cubic yards was placed in the breakwater. The work was completed in May, 1914, at a division cost of \$3,492,781.27. It contains 1,945,733 cubic yards of material, consisting of 669,254 cubic yards of dredged rock, 819,930 cubic yards of Toro Point rock, and 456,549 cubic yards of Porto Bello rock.

Work on the Naos Island Breakwater was continued throughout the year. With the closing down of dry excavation in Culebra Cut on October 10, a borrow pit was opened in the side of Sosa Hill, as from the action of the breakwater it had been concluded that too much soft material had been used in its construction and that nothing but rock should be put in to secure its completion. The work at Sosa Hill continued from October 10, 1913, until March, 1914, when the output from the dry dock, together with the character of the material warranted the use of the spoil from this locality for breakwater purposes. At the beginning of the year all the trestle had been completed to elevation plus 14 and had been filled in with the exception of 600 feet. At the close of the year the average elevation of the

breakwater was plus 18.5 and it was finished to its full width. The average settlement during the last two weeks of the year was 0.075 foot with the exception of one stretch about 600 feet in length which settled at the rate of about one-half an inch per day. During a portion of the last three months of the year there was a settlement of about 2 feet a day at the south end of the breakwater immediately north of Naos Island, whereas the settlement at the end of the year at this point amounted to only $3\frac{1}{2}$ inches per day. During the fiscal year 652,587 cubic yards were placed at an average division cost of \$0.6088 per cubic yard.

Cristobal coaling plant.—Drilling and blasting channel material in the vicinity of the Cristobal coaling plant was started by the dredging division in July, 1913, and the removal of the material by a pipe-line suction dredge was continued through the year. The dredged material was pumped ashore where most needed. Being largely clean coral rock and sand, it has been used to bring the area in which coal will be stored in the dry, measuring about 300 feet by 1,200 feet, up to elevation plus 2. Work was pushed on the construction of trestles for use in setting the 6-foot caissons, and on the construction of the two concrete walls supported on piles, about 700 feet in length, that carry the tracks for the stocking and reclaiming bridges. At the end of the year the trestle construction was about 25 per cent completed. The caissons are of steel, 6 feet in diameter, and by the end of the year 78 of the cylinders had been set, and 6 of these were driven to rock with a steam hammer in advance of any excavation. The total amount of concrete placed was 3,123 cubic yards, at an average division cost of \$5.4986 per cubic yard.

A contract was entered into for furnishing the materials, necessary machinery, and the erection in place of the coal-handling plants. The coal-handling plants are designed for the storage of 485,000 tons at Cristobal and 215,000 tons at Balboa. Of the former, 100,000 tons are to be wet storage, and in the latter case 50,000 tons.

Fuel-oil plant.—A contract was entered into on October 1, 1912, for four fuel-oil storage tanks 93 feet in diameter and 35 feet in height, each having a capacity of 40,000 barrels, to be completed at a cost of \$62,800. Two of them are located at Mount Hope and two on the Balboa dump southeast of Sosa Hill. Plans have been prepared and advertisements issued for the necessary pumping plants in connection with these tanks, one to be located at Balboa and one at Mount Hope. Provision is made for the installation of three pumps in each plant, two of which will be purchased at the present time. They will be able to handle oil from Balboa to Miraflores tank, and from Mount Hope to Gatun tank, at the rate of about 400 barrels an hour. On the Atlantic side as much of Docks 13 and 14 as is

necessary will be used as oil docks, and the tank field will be located between the east diversion and the Mount Hope Road, where there are suitable locations for 40 or 50 tanks. The pumping plant will be located immediately east of the Mount Hope filtration plant. At the Pacific terminal there will be a berth for oil vessels 75 feet wide by about 2,000 feet long immediately adjoining the canal channel and south of the old French pier. There will be three oil cribs, two of which will be constructed at once, consisting of steel and concrete deck supported by 6-foot concrete cylinders. The pumping plant will be located on the lower level of Balboa dump, opposite the oil cribs. The tank field has been laid out on the higher level of Balboa dump. An area has been reserved for the accommodation of 33 lots each 200 feet square. To the end of the fiscal year there has been expended on the fuel-oil plant at the Pacific terminal \$50,289.33, including the cost of dredging berth for ships, for which there were removed 60,776 cubic yards, at a division cost of \$0.0983 per cubic yard, and on that at the Atlantic terminal \$49,694.15.

Quay walls and pier.—Work was continued on the quay walls and pier at the Pacific end of the canal during the year. These consist of reinforced-concrete deck supported by cylinders sunk to rock. When completed the total length of the quay wall or wharf will be 2,662.65 feet, averaging 60 feet wide. Of this amount 648.78 feet were built for the Panama Railroad as a lumber dock, as reported in the previous annual report. The remaining portions of the wharf extend to the north and south of this lumber dock. The north portion is supported upon cylindrical concrete caissons sunk to rock and filled with concrete, reinforced with steel rails. The cylinders themselves are reinforced concrete 7 feet 6 inches in diameter, with 8-foot bottom section 5 feet in length. Of the section north of the lumber dock, 1,238.42 feet, 16 caissons remained to be sunk during the year, most of the substructure having been completed during the previous year. There are 136 caissons in this dock. The superstructure consists of reinforced girders, beams, and floor slab, with vitrified-brick surface. The work was begun in July, 1913, and was completed on February 1, 1914. The paving brick were laid on a sand cushion. There were 75,683 square feet of brick laid on the floor of this dock, and it was completed on April 1, 1914.

To counteract any outward pressure against the cylinders "dead men" were placed in the ground about 85 feet behind the rear edge of the wharf and opposite each transverse girder, each with an effective bearing area of 48 square feet, constructed of reinforced concrete. They were connected to the dock by steel rods $2\frac{3}{4}$ inches in diameter, drawn tight by means of turnbuckles, and encased in concrete.

The wharf south of the lumber dock is 775.45 feet in length, with a return 290 feet long, and, as the work had to be performed in water, the reinforced-concrete caissons used in the other dock were not suitable. The caissons for this portion of the work are steel cylinders 6 feet in diameter, in sections 5 feet long. In order to permit the construction of this portion of the wharf it was necessary to remove the sand-unloading cranes formerly used by the Pacific division, and the sand operations were transferred to Miraflores locks. A ladder dredge cleared the site and a double trestle was constructed longitudinally through the site for the handling of the caissons. The excavation inside the cylinders was performed by orange-peel buckets as much as possible, but the material overlying the hard rock was so firm that the greater part of the excavation had to be done by hand, using Star well drills as hoisting engines. At the close of the year 23 caissons had been sunk to rock.

The bulkhead quay wall, extending between the wharf and Pier No. 1, is 303 feet long and built on concrete cylinders sunk to rock in a manner similar to that at the wharf north of the lumber dock. Rock was encountered very much higher than on the greater part of the other quay walls, and it was necessary to do considerable rock excavation in the caissons to get them well below -45. Excavation was done by orange-peel buckets operated by locomotive cranes, but the removal of rock and cleaning out the bottom of the caissons required hand excavation. Sixty-five piers were required for this dock. They were all sunk to rock at the end of February, 1914. The superstructure was placed similar to that of the other docks. A similar bulkhead, extending from Pier No. 1 to Pier No. 2, was begun during the year.

The construction of Pier No. 1, 1,000 feet in length and 201 feet wide, proceeded in a manner similar to that of the wharf construction, both as regards excavating in the caissons and placing the superstructure. Most of the material excavated was soft, alluvial mud, rock being encountered at the upper end, which necessitated hand excavation in order to secure a foundation for the cylinders. During the year 184 piers were sunk to rock.

The division cost of this dock work in detail to date is as follows:

At the quay wall north of the lumber dock there have been excavated, in connection with the concrete cylinders and the beams for the superstructure, 23,728 cubic yards, at a division cost of \$2.2569 per cubic yard; 6,464.5 cubic yards of concrete have been laid in the construction of the caisson shells, at a division cost of \$13.0343 per cubic yard; 7,945 cubic yards of concrete have been placed within the caissons, at a division cost of \$6.6675 per cubic yard; 7,359 cubic yards of concrete have been laid in the floor system, at an average division cost of \$24.2281 per cubic yard. In paving this dock 75,683

square feet of brick paving were laid, at a division cost of \$0.3120 per square foot. This dock was completed during the year; it has an area of 77,403 square feet and the total division cost was \$421,200.57, or \$5.4417 per square foot.

At the quay wall south of the lumber dock, in dredging preparatory to the construction of this dock, 25,720 cubic yards of material were removed, at a division cost of \$0.4689 per cubic yard; 669 cubic yards were excavated for and in the piers, at a division cost of \$2.2929 per cubic yard; in filling the caissons, 1,487 cubic yards of concrete were placed, at a division cost of \$9.3277 per cubic yard. To the close of the fiscal year there have been expended in the construction of this dock \$107,956.85. In the construction of the bulkhead quay wall, extending between the wharf and Pier No. 1, 7,835 cubic yards of material were excavated in and for the piers, at a division cost of \$2.4612 per cubic yard. In the construction of the caisson shells 1,657 cubic yards of concrete were used, at a division cost of \$17.3458 per cubic yard; 3,563 cubic yards of concrete were placed within the cylinders, at a division cost of \$5.9657 per cubic yard. There were 2,462 cubic yards of concrete placed in the concrete floor, at a division cost of \$16.3920 per cubic yard, and 21 cubic yards in the concrete balustrade, at a division cost of \$33.7429 per cubic yard. Behind the structure, 2,313 cubic yards of back fill were placed, at a division cost of \$2.1406 per cubic yard. The total amount expended on this quay wall to the end of the fiscal year was \$130,306.14.

In the construction of the pier, 31,666 cubic yards of material were excavated for and in the cylinders, at a division cost of \$2.9495 per cubic yard. In the construction of the caisson shells, 10,773 cubic yards of concrete were used, at a division cost of \$12.5772 per cubic yard, and 13,346 cubic yards of concrete were used in filling the caissons, at a division cost of \$6.7139 per cubic yard. In connection with the floor system there were excavated 7,373 cubic yards, at a division cost of \$1.4920 per cubic yard; 10,222 cubic yards of concrete were laid in the floor, at a division cost of \$16.1893 per cubic yard, and 939 cubic yards of back fill were placed, at a division cost of \$1.9287 per cubic yard. To the end of the fiscal year there were expended in the construction of this pier \$511,749.14. The total expense in connection with these docks, including preliminary expenditures which have not been located to any of the docks, to the end of the fiscal year was \$1,212,917.01.

Ancon quarry.—The Ancon quarry was continued in operation during the fiscal year—by the fifth division from July 1, 1913, to February 1, 1914; by the fourth division from February 1, 1914, to May 31, 1914; and from the latter date to the end of the year under the division of terminal construction. The greater part of the work has been carried on on the upper level, which is over 400 feet above

the crushers. Two shovels were kept at work until May, 1914, since which time one shovel has been operated and the other held in reserve. In July, 1913, the bank under the crusher building gave way and threatened to carry away the lower part of the crusher building and conveyor. The material in the slide was excavated by steam shovels, working day and night, and about 40,000 cubic yards were removed and hauled to Miraflores locks for back filling and to the Balboa town site. During this time the crushers were run 12 hours a day until the danger from the slide was stopped. The large crusher was relined once, the main shaft changed twice, and the main eccentric changed twice in order to be rebabbitted.

The larger output from the quarry is designated as rock No. 1 and the smaller as rock No. 2. The demand for the latter size was greater than formerly, and the crusher had to be arranged to crush the rock smaller, the screens being changed so that a greater percentage of No. 2 rock was produced. The total amount of crushed rock produced during the year was 502,798 cubic yards at an average cost of \$0.8974 per cubic yard. In addition thereto 49,156 cubic yards of screenings were produced, which were utilized in the construction and repair of roads and in the manufacture of concrete blocks for construction of buildings.

Sand service.—The handling of sand from Chame to Balboa was performed by the dredging division, and the unloading at Balboa continued under the dredging division until February, 1914, when the unloading cranes at Balboa were closed down, owing to the necessity of moving them off the temporary dock on which they had been installed. The unloading operations were transferred to Miraflores on April 28, and unloading was performed by one of the berm cranes still remaining at that point. A locomotive crane was subsequently added, and both machines worked during May and June. A total of 199,319 cubic yards of sand was received and unloaded at an average cost of \$0.8233 per cubic yard.

Panama Railroad freight yards.—The Panama Railroad freight yards, extending from Diablo Hill to the foot of Sosa Hill, were practically completed at the end of the year. The filling and excavation for these were performed by the division of terminal construction. Material excavated from the inner harbor by suction dredges was deposited through pipe lines into the swamp lying between the site and the old Panama Railroad line, and a considerable amount of dry fill obtained from the dry-dock excavation and from Diablo Hill was added. The low, swampy area east of Balboa terminals and north of Ancon Hill was raised to a higher elevation by a hydraulic fill dredged from the inner harbor.

Colliers.—The successful operation of the coaling plants, as well as the price at which coal can be sold, is dependent in some degree

upon the ability to control the transportation of coal from the United States. During the year the cost of water transportation was \$1.395 per ton. The coal is brought down in foreign bottoms. The conclusion was reached early in the consideration of the coal-supply problem that advantages would result from the ownership by The Panama Canal or the Panama Railroad Co. of the colliers bringing coal to the Isthmus. An estimate was therefore submitted in 1912 that would permit the construction by The Panama Canal of two colliers in accordance with the latest type of naval design, and would give The Panama Canal the desired control over its coal supply. The general plans were prepared by the Navy Department, and bids were opened for their construction on February 2, 1914. On April 9, 1914, a contract was entered into for the construction of the two at \$987,500 each. Each collier is to have a coal-carrying capacity of 12,000 tons and a speed of 14 knots per hour loaded to full capacity. On June 30, 1914, the Secretary of War decided that these colliers when completed will be operated by the Panama Railroad Co. The company has submitted an estimate of the cost of transportation, which amounts to 97 cents a ton, not including depreciation or interest on the capital invested.

Tugs.—As stated in the previous annual report, an estimate was included for the fiscal year 1913 for the purchase of four harbor tugs of suitable design and sufficient power to handle the largest vessel using the canal. The plans and specifications were approved in December, 1913, and bids were invited by a circular through the Washington office on January 6, 1914. When the bids were received it was decided to reduce the number from four to two, and the contract was awarded and entered into on May 8, 1914.

Floating cranes.—A contract was entered into on April 21, 1913, for two floating cranes of the revolving type, and of 250 tons capacity each, at a cost of approximately \$837,500, to be delivered and completed on the Isthmus within 580 days, or by December 2, 1914. These cranes have been given the names *Ajax* and *Hercules*, respectively. The work has progressed satisfactorily, and the pontoons were brought from Germany and arrived on the Isthmus in July.

Balboa town site.—Planning of the permanent town of Balboa, together with the streets, water and sewer systems, was placed under this division. Previous study had served to determine the location of the Administration Building, and the formal mall of buildings on Balboa Plain as recommended by the Commission of Fine Arts. The main roadways have a width of 24 feet; the roadways of secondary importance have width of either 18 or 14 feet. The land which has been set aside for the permanent gold site at Balboa includes 29 acres on the north and northwesterly slopes of Sosa Hill, intended generally for quartering employees assigned to the shops and

terminals; an area of 72½ acres on the southwesterly slope of Ancon Hill, which has been named "Balboa Heights." Employees working in the Administration Building will be housed in this area. The third area, of about 55 acres, is on the low ground between the two areas above mentioned, on which will be located buildings of a public or semipublic character, as well as quarters. Construction work was started the latter part of August, and the progress has been governed to a considerable extent by the existing structures and tracks. Sewers and water systems have been installed and a considerable amount of grading and planting work completed. For the construction of roads asphaltic concrete was adopted as being more economical. The total amount expended on the work was \$409,116.35.

Radio station.—In addition to the foregoing work, the building of the Darien radio station was placed in charge of this division and \$74,756.88 were expended during the year on its construction.

For further particulars, attention is invited to Appendix B.

SUPPLY DEPARTMENT.

The supply department was organized, effective April 1, 1914, by combining the quartermaster's and subsistence departments under the old organization, and was placed in charge of Capt. R. E. Wood, United States Army, as chief quartermaster. The department has charge of the recruitment of labor; construction and repair of all buildings; care, furnishing, and assignment of quarters; distributing fuel, commissary supplies, and distilled water; the operation of hotels, messes, and kitchens; requisitioning for supplies of all kinds, together with the receipt and distribution of them on arrival; the cutting of grass and disposal of night soil and garbage, as prescribed by the health department.

During the year the work of the department was more arduous than that of any other on the Isthmus, by reason of the frequent changes in organization due to the consolidation of the work, the construction of new buildings, the elimination of old towns and their transfer to new localities, and too much credit can not be given to those who have had charge of the work.

The force employed on the canal dropped steadily throughout the year, being 29,673 on June 30, 1914, as compared with 43,350 at the close of the previous fiscal year. Accompanying the decrease there was a large emigration from the Isthmus, and for the first time since the work was started there was an excess of departures over arrivals of about 15,000. Free transportation was furnished to 1,361 Americans, 1,173 West Indians, and 1,615 Europeans, at a cost of \$121,765.80. The character of the force was radically changed during the year, due to the completion of dry excavation and the large increase

in the building force for the construction of quarters, offices, etc. The shop forces made two transfers, one from Gorgona to Empire and then from Empire to Balboa. The dredging forces were shifted from the terminals at Balboa and Cristobal to Paraiso. The transportation men were transferred from Las Cascadas and Empire to Balboa. These changes were made necessary by the waters of the lake drowning out Gorgona where the shops were formerly located, by the concentration of the dredging fleet in Culebra Cut, and by the abandonment of Las Cascadas so that it might be all available for the military. At the close of the fiscal year there was a total of 17,938 men, women, and children in canal quarters, as compared with 23,184 men, women, and children at the close of the previous fiscal year. The greatest percentage of decrease was among the American and European employees.

A new town, La Boca, was erected on the Balboa dumps south of Sosa Hill for the silver employees that will eventually be required for the permanent organization. Houses which had to be abandoned or moved were transferred and reerected at La Boca and converted into family quarters, and these apartments were rented. The experiment has been a success and has accomplished three good results: It has afforded the families of silver employees comfortable houses at a rental of fully 50 per cent less than they would have to pay in the city of Panama; it has enabled the canal to use to good advantage buildings which otherwise would have had to be abandoned or sold for little or nothing; and it has enabled the canal to derive a reasonable return from the investment. Fifty-two buildings, taken from Gorgona, Bas Obispo, Las Cascadas, Diablo, Empire, Culebra, Porto Bello, Gatun, Pedro Miguel, and Ancon Hospital, were moved and reerected at La Boca at a cost of \$110,045.50, or an average cost per apartment of \$266; the resulting structures accommodate 413 families. The cost varied from \$111 to \$520 per apartment and the rents range from \$3 to \$9 per month. Range closets, cook sheds, washhouses, and bathhouses for bachelor and married employees were erected at La Boca at a cost of \$15,509.16. Besides the settlement at La Boca, silver quarters at Paraiso, Cristobal, and Gatun were thoroughly overhauled and repaired and then rented. At the close of the year 153 houses, with 736 apartments and rooms, were rented to employees on the silver roll, the monthly amount realized being \$3,736.

On June 30, 1914, there were 2,535 buildings in canal settlements, of which 117 belonged to the Panama Railroad, 19 to the Army, Navy, and Marine Corps, leaving 2,399 belonging to The Panama Canal. Of this number 567 were French buildings, remaining of the total of 2,148 turned over by the French company in 1904. During the year 136 buildings were demolished and 107 were sold, real-

izing \$7,453.76, practically all French buildings. The raising of the lake necessitated the removal, demolition, and sale of all buildings at Gorgona and Matachin and most of the buildings in the labor camps at Chagres and Miraflores, and slides caused the demolition and removal of some of the buildings at Culebra. Of the 175 buildings taken down, 153 have been reerected and 22 were in course of erection on June 30. The total cost of this work has been \$308,310.63. While experience has shown that buildings can be moved faster and more economically when no alterations are made in the type, in view of the fact that the buildings being reerected at Ancon will be used for the permanent force, it was concluded that some alterations should be made so as to afford greater comfort. Work in connection with the erection of buildings for the Darien radio station for the Navy was done by the supply department. The total amount expended for this work was \$53,314.72. The permanent buildings constructed consisted of the hydroelectric station at Gatun, the substations at Gatun, Cristobal, Miraflores, and Balboa, the commissary warehouse at Cristobal, the Administration Building at Balboa, permanent family quarters of concrete blocks (28 four-family and 9 two-family), the shops office building, commissary building at Balboa, and the commissary building at Ancon. The total amount expended for these buildings, exclusive of those for the commissary, to the close of the fiscal year aggregated \$1,943,430.05.

The policy was continued of limiting the stock of material and supplies as much as possible, which necessitated the placing of frequent orders for small amounts of material, increasing the work of the storekeepers and the United States requisition division and the difficulties of the purchasing office in Washington. The value of material received during the year was \$11,116,395.10; the local purchases amounted to \$2,293,144.66. Of the local purchases, coal aggregated \$929,176.57; oil, \$863,206.66; and the purchase of tools from the McClintic-Marshall Construction Co., \$40,000. There was a decrease of 130,000 tons of cement, but a very large increase in the amount of lumber purchased. Changed conditions of the work necessitated the closing down of storehouses at various localities and the concentration of material at the terminals. The Gorgona storehouse was closed on August 15, 1913, the Miraflores storehouse on November 1, 1913, the Pedro Miguel storehouse on September 15, 1913, the Toro Point storehouse on May 1, 1914, the Porto Bello storehouse on May 15, 1914, and the Ancon storehouse on June 30, 1914. A storehouse was opened at Paraiso on December 1, 1913, a cement shed was erected for storage at Corozal, and the new buildings of the Balboa storehouse were opened during February of 1914. The Mount Hope depot invoiced material to the value of \$7,093,-

963.28, as compared with \$10,580,623 during the previous year. The value of the stock on hand at Balboa on June 30, 1914, was \$1,098,143.49.

Scrap operations were continued throughout the year, and consisted of the collection, storage, classification, and sale of scrap. Altogether a total of 30,000 tons of rail and scrap were handled at the scrap yard at Mount Hope. Exclusive of the contracts with the Chicago House Wrecking Co., under which practically no shipments were made during the year, approximately \$80,000 worth of scrap was sold. There is in addition scrap on hand at Mount Hope valued at about \$300,000 based on present market prices. The expenses of scrap operations proper amounted to approximately \$25,000 for the year. Unloaders, steam shovels, locomotives, spreaders, pile drivers, and track shifters no longer needed for the work were prepared for storage, at a total cost of \$14,222.84; this expenditure was necessary in order to secure the highest possible prices for the material.

On June 30, 1914, the department was operating the Hotel Tivoli, Hotel Aspinwall, 12 line hotels, and 10 laborers' messes, a decrease of 4 hotels and 5 messes from last year. The hotels at Porto Bello, Gorgona, Dump No. 6, Bas Obispo, Las Cascadas, and Miraflores were closed. A mess at Ancon for gold employees and the Hotel Aspinwall at Taboga Island were opened. The messes at Dump No. 6, Bas Obispo, Culebra, Gorgona, Miraflores, and Porto Bello were closed, and the common laborers' kitchen at Naos Island was converted into a laborers' mess. The gross revenue from the line hotels, restaurants, and messes was \$1,032,189.51, a decrease of \$202,888.33 from last year, while the total cost of operations was \$1,021,856.92, a decrease of \$183,942.84, making the profit \$10,332.59, a decrease of \$18,944.49. The total number of meals served in line hotels was 2,131,912, a decrease of 208,732 from last year. Immediately after July 1, 1913, the European laborers' messes and the common laborers' kitchens were combined and called laborers' messes. The total number of rations served in these messes was 950,994, the total number of rations served in both messes and kitchens during the previous year being 1,396,972. The net expense for salaries and wages was \$133,638.81, as compared with \$166,398.65 for the previous year. As the result of the year's operations the line hotels and restaurants showed a loss of \$18,366.18, as compared with a loss of \$3,837.71 during the previous year. Laborers' messes showed a profit of \$28,698.77, as against a combined profit of \$33,114.79 on messes and kitchens during the previous year.

During the last fiscal year the demand for wagon transportation was heavier than during any previous year since 1904, and it was necessary to purchase 100 new mules. As a result of necessary town-

site work, hauling of material for new buildings and those transferred, and the collection of garbage in the city of Panama, which was transferred to the health department during the year, all Government animals were worked to the limit. This overwork and the fact that all mules except those purchased during the past 15 months have averaged over seven years' service on the Isthmus resulted in the death of 50 animals, a considerably heavier loss than during the previous year.

For further details, attention is invited to Appendix F.

COST KEEPING.

No change was made in the methods of cost keeping adopted for the construction divisions in January, 1910. In addition to those reported last year, cost accounts were initiated for the Cristobal coaling plant, the gravel-reclaiming plant at Balboa, and the construction of the permanent concrete buildings, the accounts for the latter being an elaboration of the system formerly used. The costs are made up of the labor engaged in and the material applied to the work, an arbitrary to absorb the cost of the plant, and a proper proportion of the division overhead charges. The general expenses of the Canal are prorated to the different parts of the work and must be added to the division costs in order to determine the total costs. As the engineers do not necessarily have control over the items which make up these general expenses, the costs reported are the division costs except when noted to the contrary. The cost-keeping accountant reports directly to the Governor. In addition to the duties enumerated in the last annual report, the cost accounting for the work under the jurisdiction of the former central division and that for the quartermaster's department was transferred to this office on October 1, 1913, and on June 1, 1914, that of the electrical division. He has been engaged in preparing permanent accounting systems for the operation and maintenance of the canal since April 1, and to the close of the year most of this work had been completed with the exception of minor detailed accounts, which will be initiated as the necessity develops. At the close of the last fiscal year the pay roll of the office was about \$3,000 per month, and there were transferred with the accounts of the former central division and of the quartermaster's department employees whose salaries aggregated \$975 per month; the pay roll at the close of the fiscal year was about \$3,600 per month. This, notwithstanding the increase in accounting work for the terminals, the town site, the permanent buildings, and the electrical division, which exceeded by far the decrease on account of the completion of some of the canal units.

The general expenses prorated to the construction work this year amount to 11.12 per cent of the division cost and for the period to date to 8.73 per cent.

Comparative costs are not given this year for all the units of construction, as conditions due to the completion of the work make such comparisons valueless as far as a large portion of the units of construction is concerned. At the Ancon rock quarry there was a decrease of 185,503 cubic yards in the quantity of crushed stone produced and an increase of \$0.1179 per cubic yard, principally in the operation of and repairs to the crushers.

The quantity of sand dredged from Chame Point decreased 246,339 cubic yards and the cost increased \$0.1154 per cubic yard, principally in the expense of dredging and towing to Balboa.

The cost of the large rock in place in the Colon west breakwater increased \$0.4480 per cubic yard as compared with last year, due to increase in the charge for plant arbitrary, made necessary by the decreased quantity of rock placed in the breakwater as compared with the estimate.

There was an increase of \$0.3154 per cubic yard in the cost of rock placed in the Naos Island Breakwater, due to charging this account with the expense of quarrying and transporting rock from Sosa Hill and of transporting the rock secured from the excavation in the area of the dry dock at Balboa.

To the end of the fiscal year there had been expended \$440,483.46 for the construction of terminal facilities at Cristobal, of which \$390,789.31 was for the coaling plant and \$49,694.15 for the fuel-oil storage plant. For the terminal facilities at Balboa there had been expended \$6,665,446.24, of which \$1,108,773.31 were for surveys and in the preparation of the site; \$592,971.66 in dredging the inner harbor; \$504,320.59 in the construction of the main dry dock; \$78,312.02 in the construction of the small dry dock, known as Dry Dock No. 2; \$287,269.17 in the construction of the coaling plant; \$386,004.07 in excavating the entrance basin; \$126.85 in the construction of the sea wall; \$2,444,462.23 in the construction of the permanent shops, storehouses, and roundhouse; \$1,212,917.01 in the construction of the docks; and \$50,289.33 in the construction of the fuel-oil plant and in dredging a berth for the oil ships.

In the preparation of the permanent town sites there have been expended \$132,539.23 for the town of La Boca, \$409,116.35 for that at Balboa, and \$112,349.25 for that at Pedro Miguel, a total of \$654,004.83.

In the construction of the permanent concrete buildings there have been expended to the end of the fiscal year \$716,936.09 for the Administration Building at Balboa, \$425,210.17 for 28 four-family apartment houses, and \$20,737.76 for nine two-family apartment houses.

The administrative and general expenses increased \$292,404.07. Of this amount about \$120,000 is apparent only and is due to consoli-

dating the time and cost keeping forces in the executive office, the expense having previously been borne by the construction divisions. The remainder is principally due to heavy charges for repatriation of employees leaving the service or discharged for reduction of force, and to the expense of moving the storehouses at Gorgona and Empire.

For further details, attention is invited to Appendix I-2.

ACCOUNTING DEPARTMENT.

The accounting department was organized on April 1, 1914, in accordance with the provisions of the Executive order putting into effect the new organization, and consists of the auditor, Mr. H. A. A. Smith, who has supervision of the entire department and is in direct charge of the auditing and accounting work; Mr. John H. McLean is in direct charge of disbursements, and Mr. T. L. Clear of all collections.

An attempt was made to revise the system of accounting that has been in effect during the construction period so as to make it applicable to the operation of the canal. While the canal is primarily for the purpose of passing ships, under authority of law provision is made for supplying vessels with fuel, general supplies of all kinds, including subsistence, for repairs, and various other facilities, so that the system must be sufficiently elastic to take care of the various enterprises, and for the determination of net profits as nearly as may be done, which, under the law, must revert to the Treasury. The assistance of the Treasury Department was sought and two committees visited the Isthmus, the result of which was the approval of certain forms for use in connection with the rendition of public accounts. A new classification of accounts has been established beginning with the fiscal year 1915.

Under the agreement with the Republic of Panama, which requires the reimbursement to the United States for the expenditures incurred in connection with the construction, maintenance, and operation of waterworks, sewers, and pavements within the cities of Colon and Panama, the expenditures to June 30, 1914, in the city of Panama, were \$1,761,328.49 and in the city of Colon \$1,659,640.20, a total of \$3,420,968.69, including accrued interest to date at the rate of 2 per cent per annum on the capital cost balances and on the proportionate cost of the waterworks in the Canal Zone used for supplying water to the two cities, based on the quantity of water consumed. For the work in Panama this interest has amounted to \$186,588.26 and for the work in Colon \$139,665.63. There have been reimbursed to the United States \$1,213,918.37, leaving a balance of \$2,207,050.32 still due.

During the year 41,233 hotel books, valued at \$580,319.40, and 980,283 meal tickets, valued at \$353,253.20, were issued. In addition,

the sum of \$2,888,437.50 was collected on the pay rolls for commissary books issued to canal employees.

The periodical examination of the accounts of the 225 officers and employees having the collection, custody, and disbursement of money was made during the year.

The total disbursements on the Isthmus on account of salaries and wages of employees and on account of other items amounted to \$27,749,135.69. Disbursements in the United States amounted to \$14,614,403.71, or a total of \$42,363,539.40.

The total collections during the year amounted to \$8,106,469.42, of which \$4,718,024.30 were repaid to appropriations, \$379,365.02 deposited as miscellaneous receipts, and \$2,963,148.96 collected on account of Panama Railroad commissary. The balance, \$27,931.14, was collected for the account of the railroad, bonding company, and other contractors.

The inspection of time books and the work of timekeepers in the field was continued.

The property accounting was transferred to this department on January 1, 1914, and for the six months that it had charge records were maintained of purchases and sales of the quartermaster's stores, and material and supplies were received of a total value of \$7,887,431.66, of which \$4,840,245.92 were for stock and \$3,047,185.74 were for material, supplies, and equipment delivered direct to the construction divisions. During this period the issues from storehouses amounted to \$5,423,585.41, and the amount received from direct sales to outside interests totaled \$142,377.56.

The separate business of the Canal Zone has reduced materially during the year. The amount of revenue derived from rentals, taxation, etc., decreased from \$212,266.83 in 1913 to \$168,076.64 in 1914. The audited expenditures during the year amounted to \$261,064.17. In the operation of the post offices there was a decrease in the number of orders issued from 238,316 in 1913 to 198,009 in 1914.

The canal clubhouses received a total revenue of \$132,624.05 and expended \$133,086.95. The balance on June 30, 1914, in clubhouse funds amounted to \$26,513.96, with outstanding obligations of \$10,534.53.

The provisions of the injury compensation act of May 30, 1908, were superseded on April 1, 1914, by the Executive order of the President of March 20, 1914, which was promulgated in accordance with the authority contained in section 5 of the Panama Canal act. Since August 1, 1908, the sum paid out in injury claims amounted to \$1,145,085.71. For the first three months under the compensation order of March 20, 1914, there were expended \$4,283.83. This does not represent the total amount that will be allowed on account of injuries received during the period, as no allowances were made

on account of long-continuing periods of disability nor on account of death claims.

Congress has appropriated a total of \$374,048,194.59 for the canal, including the appropriation continued in the sundry civil act approved August 1, 1914. Of this amount \$12,050,825 were for fortifications and \$22,508.01 were appropriated for the relief of private persons, so that there were \$361,974,861.58, including the amount covered by the sundry civil act of August 1, 1914, appropriated for the construction of the canal and its adjuncts. Except for the portion used in maintaining and operating the canal, to which \$161,608.52 were charged, and \$2,000,000 appropriated for colliers, the amount chargeable against the total authorized bond issue of \$375,200,900 is \$359,813,253.06; up to June 30, 1914 \$6,254,203.37 were collected and returned to the Treasury as miscellaneous receipts, so that the cost of the canal, including the appropriation of August 1, 1914, stands at \$353,559,049.69.

For further details, attention is invited to Appendix G.

EXECUTIVE DEPARTMENT.

The executive department is an outgrowth of the department of civil administration. Prior to the reorganization on April 1 the department of civil administration was under the supervision of Mr. Richard L. Metcalfe, who was appointed a member of the Isthmian Canal Commission on August 9, 1913, succeeding Commissioner M. H. Thatcher. He arrived on the Isthmus on August 7, 1913, and was assigned to charge of the department on the date his appointment became effective. Since the reorganization Mr. Metcalfe has been a member of the committee for the formal and official opening of The Panama Canal, created by Executive order dated May 20, 1914. The department embraces the general office business of the Governor, the work under the supervision of the executive secretary as already outlined, the courts, and the offices of the special attorney, the district attorney, and the Canal Record. It is in charge of Mr. C. A. McIlvaine, acting under the Governor.

Customs service.—During the year 280 vessels entered the port of Balboa, of a total tonnage of 569,681, and 277 vessels cleared, of a total tonnage of 558,334. At Cristobal 295 vessels entered, of a tonnage of 832,579, and 296 vessels cleared, of a tonnage of 838,708. The usual customs services were rendered seamen and vessels, and the interests of Panama were guarded by customs inspectors on the wharves.

Administration of estates.—The estates of 452 deceased and insane employees of The Panama Canal and the Panama Railroad Co. were administered during the year, and there were 20 estates in the course of settlement on June 30. Of the estates settled during the

year, 323 were settled with the consular representatives in Panama of the countries of which the deceased were citizens or subjects, 126 estates were settled direct with the heirs, 2 estates were repaid to persons who had recovered their sanity, and 1 estate was divided pro rata among the claimants. The total amount involved was \$36,025.95.

Division of posts.—At the close of the year there were 13 post offices in operation, 6 of the 17 offices in existence at the close of the fiscal year 1913 having been discontinued, while 2 new offices were established. The sale of postage stamps and postal cards, including the revenue derived from the sale of stamp books, amounted to \$90,590.63, as compared with \$100,485.54 for the previous fiscal year, and \$463.67 were collected for second-class mail matter, as compared with \$318.84 for the preceding year. Money orders amounting to \$4,029,364.83 were issued, the fees from which amounted to \$19,048.11. As compared with the preceding year there was a decrease of \$854,259.30 in the amount, and a decrease of \$3,938.71 in the fees collected. There were 5,113 postal savings accounts opened during the year, 2,180 of which were active at its close, with deposits aggregating \$498,481. The 2,180 depositors included citizens or subjects of 51 nations and dependencies. The total amount of deposits for the year was \$1,708,530, as compared with \$1,601,616 for the previous year. In addition to the postal savings accounts there were on deposit at the close of the year \$70,750.41 in the form of money orders issued and drawn on Canal Zone post offices payable to the remitter. This amount belongs almost exclusively to employees of The Panama Canal and the Panama Railroad Co.

Division of schools.—The schools opened on October 1, 1913, with an enrollment in that month of 2,167 children, 1,109 in the white schools and 1,058 in the colored schools, as compared with 2,199 during the month of October, 1912. The total enrollment during the year was 1,270 in the white schools and 1,492 in the colored schools. No new school buildings were constructed during the year, although one building was removed and reerected and several rooms added to existing buildings. In addition to the white schools at Gorgona and Toro Point and the colored schools at Gorgona and Matachin reported closed in the report for the year ended June 30, 1913, the white school at Bas Obispo and the colored schools at Miraflores, Pedro Miguel, and Cruces were not reopened, and schools were permanently closed during the year at Mandingo December 19, 1913; Marajal colored school February 6, 1914; and branch high school at Empire on February 20, 1914; the white school at Porto Bello on April 24, 1914, and the colored school at Cucaracha on May 29, 1914. The sum of \$1,089 was collected as tuition from nonresidents of the Canal Zone, as compared with \$744 collected during the year

ended June 30, 1913. During the year medical inspection of the white schools was continued, fire drills were inaugurated during the year, and hand chemical extinguishers were installed in all the schools. A public-school athletic league was formed in the white schools, and an annual meet of the league was held on June 12, 1914, in the canal clubhouses at Balboa, Corozal, Empire, Gatun, and Cristobal. There were 198 participants.

Police and fire division.—The division of police and prisons and the division of fire protection were consolidated on April 15, 1914, under the designation "police and fire division." The positions of assistant chief of police, fire chief, and assistant fire chief were abolished and the position of fire inspector created. The station at Gorgona and the substation at Matachin were closed on July 17, 1913, and these towns were designated as call stations with police protection furnished from the Bas Obispo station. On August 31, 1913, the call station at Matachin was abolished, and on December 15, 1913, the station at Bas Obispo was abolished. On July 18, 1913, the call station at Cucaracha was abolished. On September 14, 1913, the station at Miraflores was abolished; the station at Las Cascadas on December 15, 1913, the necessary police protection being furnished from the Empire station. The Mount Hope station was abolished on April 15, 1914; the station at Paraiso on the same date, and the station at Porto Bello on May 13, 1914. The number of arrests during the year totaled 4,911, of which 4,455 were males and 456 females, as compared with 6,827 arrests for the previous fiscal year. There were 5,021 charges made against persons arrested, of which 4,713 were for misdemeanors and 308 for felonies. Of the total number of persons arrested 3,927 were convicted. There were 75 convicts confined in the penitentiary on June 30, 1914, as compared with 133 on June 30, 1913. All of the convicts, with the exception of a sufficient detail to do the necessary work at the penitentiary, were employed continuously on the construction of the Gamboa-Empire Road. The value of the labor performed, on the basis of 10 cents an hour for each convict, was \$21,615.45, and the cost of their subsistence, guarding, and clothing amounted to \$26,893.04. The operation and supervision of the public markets of the Canal Zone and the slaughterhouses were turned over to the police division, effective July 16, 1913. At Empire 1,533 animals were killed, and the revenue derived therefrom was \$5,065. The rentals derived from the stalls and tables in the public markets amounted to \$2,599.75. There were five markets in operation on June 30, 1914, three having been discontinued during the year.

In September, 1913, the fire station, together with the equipment, at Gorgona was removed to Corozal, and the one-man volunteer fire station at this point was discontinued. The Las Cascadas station

was closed on April 30, 1914, and the apparatus and equipment desired by the military authorities at that point were transferred to them. The fire equipment was withdrawn from the Bas Obispo and Porto Bello stations on August 20, 1913, and May 6, 1914, respectively. No new stations were constructed during the year, nor was any new apparatus purchased. The fire pump and turret nozzle, which were removed from the tug *Bolivar* during the preceding year, were installed on *Clapet No. 7* in August, 1913, to provide water front and harbor fire protection at Balboa. Fire protection was provided for the new piers, Nos. 8 and 9, at Cristobal, which required laying a 6-inch water main on the piers, with an ample supply of mains and standpipes. During the year 215 alarms were responded to, 8 of which were false; of the 207 actual fires 98 occurred in the property of The Panama Canal, 14 in Panama Railroad property, 27 in private property, and 68 in grass, rubbish, dumps, etc., on the Canal Zone. Of the fires in private property 11 occurred in the city of Colon, 1 in the city of Panama, 1 at old Porto Bello, in the Republic of Panama, and 14 in the Canal Zone. The largest fire in the Canal Zone occurred on January 3, 1914, in a pile of creosoted and untreated piling stored about three-quarters of a mile south of the shops at Balboa where it was impossible to drive the fire apparatus. The automobile fire engine was loaded on a railroad flat car and hauled to the scene. The total loss to The Panama Canal resulting from fire was \$14,551.71.

Courts.—The Supreme Court of the Canal Zone held 24 sessions and disposed of 29 cases—3 criminal, 25 civil, and 1 habeas corpus case—and ceased to exist on June 30, 1914.

The Circuit Court of the Third Judicial Circuit at Cristobal held its last criminal session on March 26, 1914. At Ancon the last regular session of the Circuit Court of the First Judicial Circuit was held on March 30, 1914; and at Empire the last regular session of the Circuit Court of the Second Judicial Circuit was held on March 31, 1914. While all further business relating to these courts was formally ordered over to the new district court on April 1, they continued to act on civil cases until May 1, pending the confirmation of the appointment of the new district judge. In the circuit courts during the period July 1, 1913, to May 1, 1914, there were 395 criminal cases filed and there were 4 criminal cases pending on July 1, 1913, making a total of 399. Of this total, 370 cases were disposed of, leaving 29 criminal cases pending on May 1, 1914. There were 158 civil cases filed during the period and 51 civil cases were pending on July 1, 1913, making a total of 209 civil cases. Of this number, 179 were disposed of, leaving 30 civil cases pending on May 1, 1914. There were 435 probate cases filed, which, with the 57 probate cases pending on July 1, 1913, made a total of 492 probate cases before

the court. The circuit courts held 225 sessions, and the collections amounted to \$6,327.57. The district courts were discontinued on April 1, 1914. During the period July 1, 1913, to April 1, 1914, there were 4,183 cases settled, 3,656 of which were criminal, and the rest civil. There were pending on July 1, 1913, 35 civil and 3 criminal cases, and there was pending on April 1, 1914, when the courts closed, 1 civil case.

On April 1, 1914, the courts of the Canal Zone ceased to exist, pursuant to the provisions of the Executive order of March 12, 1914, issued under authority of the Panama Canal act approved August 24, 1912, with the exception of the supreme court, which went out of existence on June 30, 1914. The judiciary created by the act of Congress above cited consists of one district court and two magistrates' courts. The district court consists of two divisions, known as the Balboa division and the Cristobal division. The former includes all that part of the Canal Zone which lies within the lines of the 10-mile zone and extends from the south bank of the Chagres River and the shore line of Gatun Lake, 87 feet above mean sea level, to the Pacific Ocean. The latter includes all of the territory within the lines of the 10-mile zone extending from the Balboa division to the Atlantic Ocean and the area of Gatun Lake beyond the lines of the 10-mile zone up to the contour line of 100 feet above mean sea level and the islands and peninsulas in and bordering on Gatun Lake which have been taken by the United States for the purposes of The Panama Canal. There is a magistrate's court for each of the towns of Cristobal and Balboa, the jurisdiction of each covering that division, into which the Canal Zone is divided as described for the district court, in which the town is located.

The district court has original jurisdiction of all felony cases, all causes in equity and admiralty, all cases at law involving principal sums exceeding \$300, and all appeals from judgments rendered in magistrates' courts. The jurisdiction in admiralty of the district court is the same as that exercised by the United States district courts and the procedure and practice are also the same. The Circuit Court of Appeals of the Fifth Circuit of the United States has jurisdiction to review, revise, modify, reverse, or affirm the final judgments and decrees of the district court of the Canal Zone in certain cases, and final appeal may be had to the Supreme Court of the United States in the same manner as appeals from the district courts of the United States.

The magistrates' courts have exclusive original jurisdiction throughout the subdivision in which situated of all civil cases in which the principal sum claimed does not exceed \$300, and all criminal cases wherein the punishment that may be imposed does not exceed a fine of \$100 or imprisonment not exceeding 30 days, or both,

and all violations of police regulations and ordinances and all actions involving possession or title to personal property or the forcible entry and detainer of real estate. The magistrates also hold preliminary investigations in charges of felony, and commit or bail in bailable cases to the district court.

In the district court under the new judicial system, during the months of May and June, 1914, 206 cases were settled—9 civil, 120 probate, and 77 criminal. In the magistrates' courts a total of 1,203 cases were settled, leaving 18 cases pending on July 1, 1914.

Negotiations carried on with the officials of the Republic of Panama included the following subjects: The enforcement of the quarantine regulations; the establishment of rates for the transportation of passengers by automobile between points in the Canal Zone and points in the cities of Panama and Colon; the enforcement of sanitary rules and regulations; the use of revenue stamps on bills submitted by the Isthmian Canal Commission and the Panama Railroad Co. against the Government of Panama; the new contract for street cleaning and garbage removal in the city of Panama; charge for interments made in the Canal Zone of the remains of persons who resided in the Republic; water supply for the village of Taboga; certification by Panaman consuls of manifests of ships clearing for ports of the Canal Zone; jurisdiction of the United States over islands and peninsulas in the Republic formed by the waters of Gatun Lake; the sale in the Republic of dynamite stolen from The Panama Canal; the collection of burial fees for interments in Canal Zone cemeteries of indigents from the Republic; the assessment of a commercial tax by the Republic on steamers of the Panama Railroad Steamship Co.; improvements in the Chorrillo district of the city of Panama; misuse of transportation issued to employees of the Republic; modification of the existing arrangement for the purchase of postage stamps used in the Canal Zone; the sale of the old Administration Building in the city of Panama; water supply for the section of Panama known as "El Hatillo"; cooperation of Panama health officers with those of the Zone in an effort to prevent the introduction of plague into Panama from infected ports on the west coast of South America; enforcement of the exclusion law in the Canal Zone; the use in Canal Zone post offices of United States postage-due stamps; modification of the existing agreement respecting the release of mail parcels received by gold employees through the Canal Zone post offices; the arrest in Panama of Panama Canal employees while engaged in the discharge of their duties; the care of patients by the health department for the Republic in consideration of the withdrawal of the request of the Panaman Government for the establishment of an independent hospital in the city of Colon; the removal of garbage and street cleaning in the city of Panama; the construc-

tion in the Republic of military trails at the expense of the United States; the segregation of stables in the city of Panama within certain defined areas; the desirability of having the Panaman Government cancel the licenses for five saloons near the Zone boundary line in the Folks River district; the granting of commissary privileges to certain persons not connected with The Panama Canal or the Panama Railroad Co.; the deportation of an American in the city of Panama charged with fraudulently representing himself as an attorney licensed to practice in the Canal Zone courts; the deportation of criminal characters from the Canal Zone; the violation of quarantine regulations; the securing of statistics concerning the health conditions in the interior towns of the Republic; the promulgation by Panama of a resolution with reference to manifests of vessels arriving at ports of the Canal Zone with cargo for consignees in the Republic of Panama; substitution of properly surcharged stamps of the Republic for surcharged United States postage-due stamps being used in Canal Zone post offices; installation and cost of municipal improvements in the area in the city of Colon set aside for the erection of manufacturing plants; protection of the revenues of Panama in connection with parcel-post entries into the Canal Zone; and the admission to Ancon Hospital, as pay patients, of Americans residing in the Republic of Panama who, on account of the character of their employment, are not entitled to hospital privileges. The relations with the Republic of Panama and with foreign representatives continued satisfactory.

Time keeping.—During the fiscal year the time-keeping work was gradually centralized, until at its close the time keeping of all departments and divisions, with the exception of the Panama Railroad Co., was being done by the time-keeping bureau. This work included the entering of time on the time rolls, the preparation of pay rolls and pay receipts, the issuing of coupon books, and the keeping of proper statistics and records of the work performed.

Clubs and playgrounds.—The division of clubhouses continued to exist from July 1, 1913, to March 31, 1914, when, in the reorganization, it became the bureau of clubs and playgrounds. Its activities were conducted under the supervision of secretaries furnished by the Young Men's Christian Association. The Gorgona clubhouse was closed on August 1, 1913, and was removed to Pedro Miguel, where it was reerected and opened January 27, 1914. The Porto Bello clubhouse was closed May 1, 1914, and is now being reerected with improvements as a clubhouse for colored men at La Boca. It has been decided to inaugurate a system of playgrounds in the permanent towns of the Canal Zone, and the installation of equipment and supervision will be under the jurisdiction of this bureau.

Canal Record.—The Canal Record was continued under the direction of the secretary of the commission, Mr. Joseph Bucklin Bishop, until April 1, 1914, when he was designated special secretary and continued in charge until July 1, when he resigned from the service. The Canal Record was on this date transferred to the charge of the executive secretary.

For further particulars attention is invited to Appendix I-1.

Law.—The law department continued in charge of Judge Frank Feuille until April 1, when the reorganization in conformity with section 4 of the Panama Canal act of August 24, 1912, became effective. Since April 1, and under authority of the act of April 6, 1914, Judge Feuille was continued as special attorney for the purpose of codifying the laws of the Canal Zone and to defend the interests of the United States before the joint land commission in the acquisition of lands in private ownership which are being taken over in accordance with the Executive order of December 5, 1912.

A number of Executive orders of a legislative character were issued during the year, the more important of which were the orders prohibiting flights over the Isthmus by machines; providing punishment to deported persons returning to the Canal Zone; fixing the legal rates of interest; prohibiting gifts or gratuities to agents, employees, or servants; providing punishment for persons engaged in the practice of hunting deer or other animals at night by the use of lanterns or torches; to establish the permanent organization for the Canal Zone; and the order conferring power upon the Governor of the Panama Canal Zone to remit fines and forfeitures, to grant pardons, reprieves, and commutations of sentences, and to establish a system of paroling prisoners.

The joint land commission, appointed under The Panama Canal treaty between the United States and the Republic of Panama, was in session during the fiscal year from July 1 until about the middle of September, when one of the American commissioners resigned, his resignation being followed by that of the other American commissioner not long thereafter. The land commission as then organized heard and disposed of 1,253 claims. Of these 602 were dismissed and awards made in 629 cases. The commission disagreed in 22 cases. During the same period the law department settled 752 claims, aggregating the sum of \$48,659, without the intervention of the joint land commission. From the date of the discontinuance of the sessions of the joint land commission until the end of the fiscal year the law department adjusted 1,528 claims, aggregating the sum of \$96,080.50; so that the total number of claims settled without the intervention of the joint land commission during the fiscal year was 1,903, aggregating the sum of \$147,452.50. On the 25th of May, 1914, the joint land commission was reorganized with Messrs. Federico Boyd and

Samuel Lewis, who served on the previous commission, and Messrs. Levi Monroe Kagy and David Marks, the two American members. The work of the commission was interrupted soon thereafter by the death of Commissioner Marks, which occurred at Ancon Hospital on July 17, 1914.

All leases for lots in the Culebra and Empire districts, including the villages of Empire, New Empire, Camacho, Golden Green, New Culebra, Cow Pen, and West Culebra, were canceled on behalf of the Panama Railroad, effective June 30, 1914. At the same time leases for Panama Railroad lots in the town of New Gatun were canceled, but the cancellation did not become effective until after the close of the fiscal year.

For further details, as well as statements of civil and criminal matters handled by the department of law in the courts, attention is invited to Appendix I-3.

WASHINGTON OFFICE.

The work of the Washington office continued in charge of Maj. F. C. Boggs, United States Army, and the organization remained as previously reported until April 1, 1914. On that date, under the provisions of the Executive order of March 2, 1914, the office of assistant auditor was created in place of the office of assistant examiner of accounts. Under the assistant auditor was placed a disbursing clerk, and the disbursing office was abolished. The scope of the work was about the same as previously reported, except that practically all of the independent inspection forces which were located at points in the United States outside of Washington were abolished or greatly reduced. Due to a continued effort to reduce the supply of material on the Isthmus to a minimum, the work of the purchasing department was even greater than during the previous fiscal year.

During the year 2,248 persons within the United States were tendered employment for duty on the Isthmus in grades above that of laborer; 1,429 accepted and were appointed, covering 71 different classes of employment.

The total amount of purchase orders placed was \$12,392,407.78. Many of the largest contracts were for permanent equipment: For chain fenders and chain, \$192,865.90; coal-handling plants, \$1,929,103.85; terminal facilities and docks, \$224,004.44; floating caisson, \$333,851.20; single track movable span bridge, \$55,674; transmission line, \$505,511.84; filtration plants, \$150,576.79; material and equipment for buildings and quarters, \$53,824.02; Balboa shops, buildings, \$155,547.89; machinery, \$146,367.16; two 12,000-ton colliers, \$1,975,000; 2 tugboats, \$304,000; and 9 gasoline motor boats,

\$54,392. Other principal items purchased included 2,490 pounds of explosives, 22,200,000 feet of lumber, 20,000 crossties, and 18,311 piles. During the year 592,674 barrels of cement were purchased.

For further details, attention is invited to Appendix J.

OPERATION AND MAINTENANCE.

As already outlined, the organization made effective April 1, 1914, provided for a department of operation and maintenance under the governor, who was to be assisted in the administration of the department by an engineer of maintenance and a superintendent of canal transportation. Capt. Hugh Rodman, United States Navy, having been ordered by the Secretary of the Navy to report for duty, was appointed superintendent of canal transportation, and was charged with the safe conduct of vessels through The Panama Canal, except at the locks. He was also given supervision of the port captains, the board of local inspectors, the pilots, the operation of lights and beacons subsequent to June 15, and the inspection and admeasuring of vessels. The offices of the captains of the ports at Cristobal and Balboa were established on May 5, and they were charged with the duty of the assignment of wharves, docking and berthing of vessels, furnishing of pilot service to shipping, the admeasurement of vessels for transit through the canal, and the general supervision and enforcement of canal and harbor regulations relating to shipping. Eight pilots were appointed—four at each end, and their services have been utilized in piloting vessels in and out of the terminal ports, in connection with lightering cargo through the canal, in familiarizing themselves with the aids to navigation and with the canal route.

Due to the condition of affairs in Mexico and the interruption of the Tehuantepec route, demands upon the Panama Railroad for the transshipment of freight became so great that it was necessary to institute a barge service through the canal, and this was made effective on May 15, when the barges were towed through the canal from Colon to Balboa, and continued the rest of the year. Tolls were paid by the Panama Railroad Co., and aggregated for the year \$11,610.69.

Maintenance work was undertaken at the locks and covered miscellaneous repairs, as well as the care necessary to keep the machinery in satisfactory working order. The maintenance charges were made applicable only after the work had been entirely completed in each instance. The amount expended for such repairs and maintenance work aggregated \$120,287.99. The heavier expenditures were at the locks and were incurred in connection with the gates, emergency dams, miter gate moving machines, rising stem

valve machines, cylindrical valve machines, and in lighting. Work was also done in repainting the gates, caissons and caring for the machines of the spillways. There were also expended \$16,570.44 of the amount above noted for maintenance in clearing vegetation and pulling trees from the canal channel, and removing timbers and driftwood from the vicinity of the locks.

For further details concerning the transportation division of the work, attention is invited to Appendix E.

SANITATION.

The sanitation of the Canal Zone was placed in charge of the health department, under Lieut.-Col. Charles F. Mason, United States Army, as chief health officer, and this department is charged with the care of the sick and injured of the Canal Zone, the prevention of disease in the Canal Zone and the cities of Panama and Colon, street cleaning and garbage removal in the latter cities, and all matters relating to quarantine. Lately, matters relating to charity have been added to its scope. The administration is divided into three divisions, each having its own special work to perform—the division of hospitals and charities, the sanitary division, and the quarantine division.

Division of hospitals and charities.—This division maintains hospitals at Ancon and Colon and assists in maintaining the Santo Tomas Hospital in the city of Panama. It also maintains institutions for the care of the insane and lepers of both the Canal Zone and the Republic of Panama and for employees permanently disabled through injury. It provides a dispensary with a physician and necessary attendants in each of the districts into which the Canal Zone is divided. These district physicians attend the sick within their districts, send patients to the hospital, perform vaccinations, make inspections of schools, hotels, restaurants, Canal quarters, etc., and report all births and deaths.

Sanitary division.—The sanitary division has three sections—the health office of Panama, the health office of Colon, and the Canal Zone section. In the Canal Zone section each district has a sanitary inspector, with necessary foremen and laborers, all under the direct charge of a general inspector. These inspectors keep close watch upon their districts, with a view of preventing and controlling conditions which might give rise to disease, and especially endeavor to prevent the breeding of disease-carrying mosquitoes and flies. For this purpose they supervise the construction and maintenance of drainage ditches, and the cutting of grass and brush, oil pools and the edges of large bodies of water, supervise the removal of garbage and night soil, trap and catch mosquitoes in Panama Canal quarters,

disinfect pit and other closets, and disinfect buildings for contagious diseases. They are charged with the enforcement of the sanitary regulations, and have authority to personally make arrests when they have witnessed a violation of the regulations. They also issue burial permits, make interments of the dead, and care for cemeteries. They keep charts of the prevalence of malaria in their districts, and immediately investigate and take action upon any increase therein.

The work done by the health officers of Panama and Colon is that done by health officers everywhere. In addition, they have charge of street cleaning, garbage removal, grass and brush cutting, oiling of pools, fumigation, disinfection, etc. Their duties in enforcing sanitary rules and regulations are extensive and include vaccinations, the control of infectious and contagious diseases, special precautions against quarantinable diseases prevailing in the Tropics, control of burials, inspection of slaughterhouses and of cattle for slaughter, inspection of markets, enforcement of pure-food regulations, inspection of bakeries and dairies, examination of milk, inspection of stables, bottling works, and barber shops. A large part of their time is given up to enforcement of the sanitary building regulations, especially with reference to rat proofing as a protection against plague.

Quarantine division.—The quarantine division is in direct charge of a chief quarantine officer and maintains large establishments at each end of the canal—one for the cities of Panama and Balboa and the others for the cities of Colon and Cristobal. It also maintains a quarantine officer at Bocas del Toro, for the control of quarantine matters at that port. This division, already large, is expected to increase greatly in proportions when the canal is open to traffic, and will include some new features in the arrangement for the passage of ships through the canal in quarantine. A piece of ground on the Balboa dump, fronting upon the canal and adjoining Fort Amador on the south and the radio station on the east, has been assigned as a permanent site for the Panama quarantine station. A board has been appointed to select a site for a permanent quarantine station at Cristobal.

For further details, attention is invited to Appendix H.

FORTIFICATIONS.

Work was continued during the year on the gun and mortar batteries, and by the close of the year the concrete work was practically completed, as well as the greater portion of the back fill. On July 1, 1913, the construction of redoubts in accordance with plans prepared by a board appointed for the purpose and approved by the Secretary of War, was undertaken, and they were completed, as well as the clearing necessary in connection with them.

The work was in charge of Lieut. Col. George R. Goethals, United States Army, assisted by Lieut. A. H. Acher, United States Army; Lieut. C. Garlington, United States Army; and Mr. R. M. Elder, superintendent of construction.

The following appendixes are herewith:

Increases in salaries and personnel, submitted in compliance with law, Appendix K.

Laws recently enacted affecting the canal, and Executive orders issued during the fiscal year, Appendix L.

Charts showing the organization in effect July 1, 1914, Appendix M.

Respectfully submitted.

GEO. W. GOETHALS,
Colonel, Corps of Engineers, United States Army,
Governor.

The Hon. LINDLEY M. GARRISON,
Secretary of War, Washington, D. C.

APPENDIX A.

REPORT OF THE ENGINEER OF MAINTENANCE.

CULEBRA, CANAL ZONE, *July 15, 1914.*

SIR: I have the honor to make the following report of the operations during the fiscal year ended June 30, 1914, for the work under my general supervision.

At the beginning of the fiscal year this work was organized as the first division of the office of the chief engineer, and consisted of subdivisions charged with (a) design of lock gates and protective devices, including inspection of construction and erection under contract; (b) design of operating machinery and electrical installation, including inspection and erection; (c) design of emergency dams, including inspection of construction and of erection under contract; and (d) design and construction of aids to navigation.

On October 15, 1913, the work remaining to complete the locks, with the exception of the back fill, was transferred from the Atlantic division and fifth division to the first division. The subdivisions having the lock gates and emergency dams in charge completed their main work during the year and were merged with the subdivision concerned with the design and erection of the operating and electrical machinery on April 15 and January 31, 1914, respectively.

On April 1, 1914, the first division was reorganized as the division of erection and the division of lighthouses. These, together with the division of municipal engineering, the newly created electrical division and the office engineer, with the sections engaged on meteorology and hydrography, and on general surveys, were ordered to report to the undersigned as engineer of maintenance. At the close of the fiscal year the work under my general supervision was organized as follows:

The division of erection, under the supervision of the electrical and mechanical engineer, in charge of the completion and operation of the structures of the locks and spillways, the installation, erection, testing, operation, and care of lock and spillway operating and protective machinery; the construction of power plants and transmission line; the handling of vessels while in the locks; and the necessarily accompanying designing and drafting.

The electrical division, under the supervision of the electrical engineer, in charge of power plants and transmission lines when completed, and of the inspection and testing of electrical equipment.

The division of municipal engineering, under the supervision of a resident engineer, in charge of the maintenance of all roads, streets, sewers, water lines, and air lines in the Canal Zone, and the construc-

tion of the same, except in the new town of Balboa; of the operation and maintenance of pump stations and water purification plants; of the inspection of plumbing; of the construction and maintenance of sanitary ditches; and of the design and construction of the new waterworks and purification plants for the two ends of the canal; it also has charge of the municipal work and the collection of moneys from water rents within the cities of Colon and Panama.

The office engineer.

The section of meteorology and hydrography.

The section of general surveys.

LOCK GATES AND PROTECTIVE DEVICES.

This subdivision was under the immediate charge of Mr. Henry Goldmark, designing engineer, assisted in the office by Mr. Lewis A. Mason, assistant engineer, and the necessary draftsmen and clerk. The inspection of the lock gates and the chain fenders in the United States was under the immediate charge of Mr. Johannes Hammer, assistant engineer. The inspection of the floating caisson in the United States was under the charge of Mr. Lewis A. Mason, assistant engineer. On the Isthmus Mr. E. H. Baughman was chief inspector of the chain fenders, and Mr. George F. Guynn of the erection of the lock gates.

The construction and erection of the lock gates was continued and completed during the period covered by this report, under the contract with the McClintic-Marshall Construction Co., dated June 21, 1910, and the supplemental contracts mentioned in the annual report for 1913.

The following table gives the dates for completion under the supplemental contract of May 20, 1913, and the dates on which the gates were actually completed according to the terms of that contract:

Gates.	Contract dates of completion.	Dates of actual completion.
Lower guard gates, Gatun.....	June 15, 1913	June 14, 1913
Upper guard gates, Gatun.....	Oct. 1, 1913	(¹)
All other west side gates, Gatun.....	do.....	Sept. 24, 1913
All other east side gates, Gatun.....	Jan. 1, 1914	Dec. 30, 1913
Upper guard gates, Pedro Miguel.....	June 1, 1913	May 31, 1913
Lower guard gates, Pedro Miguel.....	June 15, 1913	June 13, 1913
All other east side gates, Pedro Miguel.....	Oct. 1, 1913	Sept. 30, 1913
All other west side gates, Pedro Miguel.....	Jan. 1, 1914	Dec. 30, 1913
Upper guard gates, Miraflores.....	June 15, 1913	June 14, 1913
Lower guard gates, Miraflores.....	Sept. 1, 1913	Aug. 20, 1913
All other west side gates, Miraflores.....	Oct. 1, 1913	Sept. 30, 1913
All other east side gates, Miraflores.....	Mar. 1, 1914	Jan. 10, 1914

¹ Practically complete before supplemental contract was made.

The McClintic-Marshall Construction Co. completed all work under their contract with the Commission on the following dates: Pedro Miguel, January 8, 1914; Miraflores, January 19, 1914; and Gatun, January 26, 1914.

The work remaining to be done at the beginning of the fiscal year consisted of assembling about 3 per cent of the material in all gates, driving about 9 per cent of the field rivets; of the finishing—i. e., the work remaining to be done after the riveting is completed—about 43

per cent was required in order to complete the work. All of the leaves in the west chamber at Gatun and the east chamber at Pedro Miguel had been stepped on their pintles, and all the leaves in the west chamber at Miraflores except the two leaves of the operating gate in the lower chamber. The guard gates in both chambers of all locks were also in place.

The work was pushed with so much energy that all gates necessary for locking a vessel through on one side of the twin locks were completed prior to October 1, 1913.

The gates were first used for locking at Gatun September 26, 1913, and at Miraflores and Pedro Miguel October 14, 1913.

The original contract provided for the painting of the gates by the contractor with three coats, two of red lead, the contractor to furnish material and labor; the third of some other pigment, the contractor to furnish the labor and the Commission the material.

In order to provide more complete protection, it was decided to modify this arrangement.

At Gatun it was decided to use two coats of red-lead paint and two additional coats. In that part of the gates in the lower lock which were constantly under water, one coat of United States Navy anticorrosive and one coat of antifouling paint were applied over the red lead. On the rest of the gates at Gatun two coats of graphite paint, consisting of about equal parts of graphite and red lead, were applied.

At Pedro Miguel no red lead was used, except in the upper guard gates, the covering consisting of three coats of an approved damp-proof paint.

At Miraflores the gates in the lower lock, from elevation -6 to the bottom, were given two coats of red lead, followed by one coat of anticorrosive and one coat of antifouling paint. All the other gates were given three coats of an approved proprietary paint consisting of a hydrocarbon mixture.

On account of the delay in the receipt of the damp-proof paints intended for use at Pedro Miguel, some of the Pedro Miguel gates were painted with hydrocarbon paint from Miraflores, and conversely a few of the Miraflores gates were coated with the damp-proof paint. The third and fourth coats were in all cases applied by the Commission forces, the contractor furnishing all the red-lead paint required and also the labor for applying the first two coats on all the gates of the canal. A small portion of several of the gates at Gatun were coated with bitumastic compounds applied directly to the metal work, which had been cleaned and scraped as far as possible.

Under the action of the water of Gatun Lake, which at times contains considerable sulphureted hydrogen, organic matter, and other impurities, none of the above paints, except the bitumastic, has proved entirely satisfactory. In those parts of the gates that are continuously under water the paints are, in many places, in poor condition, although the gates have been in service only a short time. The parts not continuously under water so far remain well protected, as well as the portion which is never submerged.

The action of the gates in service has been entirely satisfactory. The leakage at the quoin and miter posts, and at the sill, is extremely small.

The office work on the lock gates consisted of the preparation of plans for metal shields to be placed on the top girder for protecting the electrical and mechanical equipment from injury by water, and of various minor plans for painter's scaffolds, etc. A complete set of record plans showing the gates as actually built was also made. These drawings, 22 in number, are of the standard size. They include a general drawing of each of the gates, as well as enlarged plans showing the sheathing, horizontal girders, and all important details, both in the gates and in the anchorages, and other fixed irons embedded in the masonry.

A report was also prepared giving the methods of calculation employed in determining the strength of the gates and a complete statement of the stresses in the principal members. These were recalculated to conform with the actual weights and dimensions of the gates as built.

CHAIN FENDERS.

A somewhat detailed description of the chain fenders was given in the annual report for 1911 and an account of the tests made to determine the best form of resistance valve in the report for 1912.

The additional tests, referred to in the last annual report, as required in order to determine the most suitable pressure for setting the valves, were carried out in February, 1914. The arrangement of the apparatus was quite similar to that used in last year's tests. Fender machine No. 812 at Gatun was used; the chain was, as before, connected with a wire rope to a lidgerwood unloader on the lock wall and put under strain by the winding engine. An hydraulic dynamometer was added for measuring the pull in the wire rope close to the unloader. Indicator cards were taken simultaneously at the dynamometer and at the upper cylinder in the fender machine. The indicator in the fender pit and the resistance valve were directly connected to the upper cylinder, so that the loss of head in the piping between the cylinder and the valve was eliminated. The readings at the dynamometer gave directly the tension in the chain outside of the hawse pipe, while a comparison of these readings with the corresponding pressures in the cylinder gave a measure of the frictional resistances. The pull on the chain was first exerted at 90° to the lock wall, so that the chain did not touch the hawse pipe, while in a second series of observations the pull was at an angle of 25° to the wall, introducing hawse-pipe friction. In the first case, the internal resistance, including the weight of the intermediate cylinder, was constant for all pressures. In the second case, the hawse-pipe friction was found to be approximately proportional to the cylinder pressure. The total resistance consisted of the hawse-pipe friction added to the internal resistance of the machine. It was found that a cylinder pressure of 360 pounds per square inch corresponded to a working load of 220,000 pounds in the chain; and the above pressure was adopted for the setting of the valve. The total resistance at this pressure will be about equally divided between the hydraulic resistance in the cylinder and the mechanical friction.

The construction of the fenders was prosecuted during the present fiscal year under the contracts with the United Engineering & Foundry Co. and the General Electric Co., which were referred to in the annual report for 1913.

On June 30 the machinery, pumps, and electric equipment had been delivered on the Isthmus for all fenders at Gatun and Pedro Miguel and Miraflores.

The erection has been somewhat delayed by slow deliveries. At the close of the fiscal year all fenders at Gatun were mechanically complete and the electrical was progressing rapidly. At Pedro Miguel seven fenders were mechanically complete, and at Miraflores one fender was mechanically complete. The electrical work was progressing as rapidly as the mechanical work would permit.

Chain.—The manufacture of the chain for the fenders has proceeded rather slowly.

As noted in the report for 1913, the chain used in the experiments for testing the resistance valve in machine room 813 was broken in the final test when the pressure in the upper cylinder had reached about 630 pounds per square inch. This pressure corresponds to a pull on the chain of 178,600 pounds, without allowance for friction, or about 213,000 pounds, if a proper addition is made for the weight of the moving cylinder and the internal friction of the machine. There were doubtless some additional secondary stresses. According to the test reports, several doublets of this chain had stood successfully a breaking load of over 457,000 pounds, and the whole section a proof test of 242,000 pounds. Examination showed that the break in the chain had occurred in a bad weld. A test of the broken chain was made at the Boston Navy Yard June 9 and 11, 1913. The section tested consisted of 45 links. It broke under a tensile stress of 360,000 pounds. Analysis gave a carbon content of 0.18 of 1 per cent, indicating that the material was steel and not wrought iron.

A second set of tests was made with sample chains about 35 feet long manufactured especially for this purpose by the navy yard at Boston, and by Messrs. Bradlee & Co., of Philadelphia. These tests showed breaking strengths of 400,000 pounds for the open-link and 470,000 pounds for the stud-link type, the results being practically the same for the two makes of chain.

On the basis of these and other tests, a specification was prepared for the manufacture of the remaining chains, and 15 chains have been ordered.

LOCK-ENTRANCE CAISSONS.

A description of the caissons for closing the entrance to the locks, including the pumping plant for unwatering the lock chambers, was given in the annual report for 1913.

As stated in that report, an invitation for proposals (Circular 778) was issued on May 21, 1913. Although a special effort was made to obtain bids from shipbuilding firms in Europe, as well as in the United States, only two proposals were received. The Seattle Construction & Dry Dock Co., of Seattle, Wash., offered to build two caissons and deliver them to the Commission at Seattle for the total sum of \$952,000. The other bid was made by the Union Iron Works Co., of San Francisco, Cal. They offered to construct the two caissons according to the Commission's specifications and plans and deliver the same at the port of Ancon for the sum of \$648,300. The price for one caisson was \$330,760. On August 20 the award of one caisson to the Union Iron Works was authorized, the contract being signed August 22, 1913. Work under the contract began in Septem-

ber and has proceeded at a satisfactory rate. It is believed that the caisson will be completed little, if at all, behind the contract date.

General and detail plans were also prepared for a floating caisson to be used for closing the entrance to Dry Dock No. 2 at Balboa. These plans have not been finally checked and approved.

PONTOON BRIDGE.

Considerable time was devoted to the preparation of the general and detailed plans for a movable bridge across the canal at Paraiso. The work of construction was done by the forces of other divisions, this office acting in a consulting capacity. The detailed plans of the mechanism for lifting the apron girders and for turning the pontoon were made under the direction of the electrical and mechanical engineer.

The adopted design provides for a floating bridge revolving about a pivot at one end, similar to pontoon bridges successfully used for many years on the upper Mississippi. Plans of these bridges were furnished by the courtesy of Mr. C. F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul Railway Co.

The general plan of the bridge is shown on plate 136. It consists essentially of a timber barge, supporting a continuous framed trestle for carrying the railroad and highway floor. Steel apron girders connect the trestle with concrete piers on each bank. The shore approaches are pile trestles.

The pivot about which the bridge turns is a heavy steel tube fastened to the east pier, and the pontoon when closed is secured to the west pier by an automatic latch. In order to give a clear channel of 300 feet when the bridge is open, the pontoon was made 378 feet long overall. It is 55 feet wide and 6 feet 3 inches deep at the center line. The frame spacing is 24 inches, the floor timbers being 4 by 12 inches, the rake timbers 4 by 12 inches, and the deck beams 4 by 10 inches. At intervals of 14 feet there are trussed frames consisting of three ordinary frames bolted together and braced with steel rods $1\frac{3}{8}$ inches in diameter. The trestle sills are carried on these special frames. Six solid longitudinal bulkheads of 8-inch timber extend the entire length of the pontoon. The base of rail is about 33 feet above the bottom of the barge or 30 feet above the water level. Its height was fixed so as to give a moderate gradient on the approaches. The trestle bents consist of a 12 by 14 inch sill 40 feet long, six 12 by 12 inch posts and 12 by 14 inch caps, 18 feet long. The outer and intermediate posts are heavily battered, distributing the weight over the whole width of the barge. There is ample transverse bracing. Under each rail there are two 10 by 16 inch and one 8 by 16 inch stringer, with an additional 8 by 16-inch stringer on each side for carrying the highway floor. The ties are 8 by 8 inches, 21 feet long, and support a roadway on each side of the railroad track.

As the pontoon itself has but little longitudinal stiffness, the trestle was designed to act as a stiffening truss for withstanding the heavy bending moments and shear that will prevail under a moving train. The track stringers were fitted with plate splices, so as to form a continuous chord, and a similar chord was provided by heavy timbers at the bottom of the barge. The trestle bents act as verticals for the truss, while the diagonals are rods 2 inches in diameter

with upset ends and turnbuckles. There are two diagonals per panel in each direction in each truss. The trestle is further stiffened by horizontal girts and a double bracing of 3 by 10 inch timbers on the outer post on each side. The timber used consisted of an approximately equal amount of Douglas fir and long-leaf yellow pine. All exterior and interior surfaces were coated with Avenarius carbolinum, applied cold. It was found necessary to add braces and hog bars to stiffen the framing and prevent distortion of the ends of the pontoon below the approach aprons.

The apron girders at each end provide automatically for a variation of about 6 feet in the water level of the canal. They are 64 feet long, consisting of spare lock-gate parts, and rest on hinged supports at both ends. When the bridge is turned, these girders are lifted clear of the concrete piers by an electrically driven mechanism and temporarily supported by blocking on the ends of the barge. The bridge is revolved by means of a 1-inch anchor chain fastened at each bank, which passes around an electrically driven wild cat on the deck of the pontoon near the west end. The mechanism for lifting the apron girders, and for turning the bridge, and also for operating the rail lift, the rail latches, and the main latch at the west pier, is operated from a central panel.

It takes 10 minutes to turn the bridge and about 45 minutes to make a complete operation, including unlocking, opening, closing, and relocking.

TRANSFER OF THE WORK.

On April 1 the main force of this subdivision was disbanded, and on April 15 the organization was entirely terminated, and the completion of its remaining work, consisting mainly of the chain fenders and floating caissons, was turned over to the newly organized division of erection.

OPERATING MACHINERY AND ELECTRICAL INSTALLATION, DIVISION OF ERECTION.

The mechanical and electrical installation, to which was added on October 15, 1913, the completion of the locks, except the back fill, was under the electrical and mechanical engineer's subdivision of the first division until April 1, 1914, when this subdivision was reorganized as the division of erection. Throughout the year it has been under the immediate supervision of Mr. Edward Schildhauer, electrical and mechanical engineer, assisted in the office by Asst. Engineer C. B. Larzelere during the first six months, and Asst. Engineer C. J. Embree during the second six months, with the necessary draftsmen and clerks. His principal assistants in the field work were Mr. E. E. Lee, superintendent of erection; Mr. F. C. Clark, assistant superintendent of erection and superintendent of the Pacific Locks; Capt. William F. Endress, superintendent of Gatun Locks; and Messrs. R. H. Whitehead, S. H. Grauten, and E. D. Stillwell, testing engineers. An average force of 371 gold and 2,350 silver employees has been at work during the year.

The detailed report of the division, written for Mr. Schildhauer by Mr. Embree, is attached hereto as Appendix A-1.

CONCRETE.

In completing the locks a total of 43,358 cubic yards of concrete were placed during the year.

HYDROELECTRIC GENERATING STATION.

The building and equipment were turned over to the permanent operating force on June 18, 1914.

TRANSMISSION LINE.

The erection of track span bridges and wiring of the transmission line was completed during the year, with the exception of six bridges near the terminals which required special treatment; 794 double and 20 single-track span bridges have been placed. The finished part of the line is 44.46 miles long and is in duplicate, having 266 miles of 2/0 stranded copper conductor and 88 miles of copper-clad ground wire.

LOCK MACHINERY.

The installation and wiring of the lock-operating machinery was completed during the year except for the chain fender machines and some electrical work on the valve machines. The entire number of machines have been placed in service, except for the chain fender machines, as follows:

- 116 rising-stem valve machines.
- 120 cylindrical valve machines.
- 12 auxiliary culvert valve machines.
- 18 guard valve machines.
- 92 gate-moving machines.
- 46 miter forcing machines.
- 80 hand-rail machines.

Twenty-one towing locomotives have been delivered out of 40 on order, and the track work has been finished, except for a part of the lower lock at Miraflores, for which the material is ordered but not yet delivered.

SPILLWAY MACHINES.

The spillway-gate machines have all been erected and wired. The gates of Gatun, 14 in number, have been tested and turned over to the electrical division for operation. The tests of the eight machines at Miraflores were suspended when partially finished, in order to move the caisson to Gatun, where it was needed for more pressing work.

CONTROL BOARD.

The control boards at all localities have been finished and are in regular operation.

LOCKAGES.

The first lockages of vessels were made as follows:

At Gatun.—September 26, 1913, of the tug *Gatun*.

At Pedro Miguel.—October 14–24, 1913, of three barges.

At Miraflores.—October 14, 1913, of a clapet, the tug *Miraflores*, three barges, and the launch *Birdena*.

The total number of lockages made during the year is as follows: At Gatun, 109; at Pedro Miguel, 70; at Miraflores, 81.

The vessels passing have, in general, been small, consisting of pieces of the floating plant of the canal or tows of barges engaged in transporting freight for the Panama Railroad. The seagoing dredges *Culebra* of 5,300 tons, the *Caribbean* of 5,300 tons, and the *Corozal* of 3,600 tons displacement have passed the locks on several occasions. The steamer *Alliance* of the Panama Railroad line, with length of 335 feet, beam of 42 feet, and displacement of 9,000 tons, passed the Gatun Locks in both directions on June 8. The steamer *Ancon* of the same line, with length of 489 feet, beam of 58 feet, and displacement of 18,000 tons, made the same trip on June 11. The *Santa Clara* of W. R. Grace & Co.'s line, with length of 404 feet, beam of 54 feet, and displacement of 11,000 tons, passed the Pacific Locks going up on June 18 and returned the next day.

In all of these lockages the same procedure was followed. The vessel on approaching the locks slowed down and came to a stop against the middle wall, with bow close to the fender chain above or below the locks. Lines from four locomotives were then passed on board, the leading two being made fast to the forward towing bitts, and the trailing two being made fast to the after towing bitts. The lock superintendent directed the operation of the locomotives from the vessel's bridge. The vessel was put in motion by the leading locomotives and brought to a stop at the proper time by the trailers. Hand lines were carried along the walls by parties of the lock force and put over snubbing posts to assist in steadying or holding the vessel.

Except when filling the lower locks at Miraflores and Gatun, where the meeting of the salt and fresh water causes some curious phenomena, no difficulty is experienced in holding the vessel in a central position by the locomotives while towing or while equalizing levels. Some time is lost in attaching the lines of the locomotives, this process taking usually from 5 to 10 minutes. The lines from the middle wall, against which the vessel lies, can be made fast easily and rapidly. The bowline from the side wall can also usually be brought on board without difficulty, but the trailing locomotive on the side wall is necessarily far from the stern towing bitts to which its line is to be attached, and the steel towing cable must either be hauled on board by the vessel's crew, paying in on a long manila line, or it may be carried to the vessel's stern by a power launch and handed on board by a short heaving line. The former process may take a good deal of time, as some 500 feet or more of manila line may have to be taken in before the loop of the towing cable can be passed over the bitts; the latter process is smart and rapid, but a launch is not always available.

After the lines have been made fast the process of towing through the lock is smooth and easy. The largest of the vessels tried, the *Ancon*, took 1 hour and 45 minutes to pass the Gatun Lock flight going up and 2 hours going down, both times being taken after the towing lines were passed on board. On the down trip the boat remained in the lower lock for some time after the lower gates were opened, to avoid surface currents created in the tail-bay by

the rush of the fresher water out of the lock. The *Allianca* took 1 hour and 31 minutes on the up-bound trip. The down-bound trip was utilized to make certain experiments with a dynamometer, and the time is not recorded. On the up trip the *Santa Clara* took 1 hour and 2 minutes to pass Miraflores Locks and 31 minutes to pass Pedro Miguel Lock. On the down trip 36 minutes were taken at Pedro Miguel and 1 hour and 42 minutes at Miraflores, the vessel lying for about half an hour in the lower lock to discharge passengers.

Some of the smaller tows have made much better time in the locks, one having passed through the Gatun Lock flight in 53 minutes.

During the towing the vessel makes no use of her own motive power, this being strictly forbidden. When the last gates in the lock flight have been passed and the bow of the vessel nears the splay of the approach wall, it is usual to slacken and cast off the towing lines at a given signal and to allow the vessel to proceed under her own power without necessarily tying up against the approach wall on the way out.

The lock superintendent or other official conducting the lockage directs the locomotives by signals. As the force of the locomotives may be exerted or released by motion on the track, or by coiling the towing line in or out from a stationary position, and, as the coiling mechanism has two speeds, the superintendent must watch the locomotives closely, and careful and experienced men are needed on the bridge of the vessel and in the cabs of the locomotives. Thus far little difficulty has been experienced in maintaining satisfactory control of the craft which have been towed through the locks.

HYDRAULICS OF THE LOCKS.

The operation of the locks has developed certain facts in regard to the action of the flowing water which are worth putting on permanent record.

It will be remembered that in the upper lock of each flight the gates at either end are doubled, the upper end having guard gates and upper gates, and the lower end safety gates and lower gates. These duplicated gates are usually both operated at each lockage. The space between the guard gates and the upper gates is regulated by an auxiliary culvert and may be put into communication with the upper pool or the lock chamber. The space between the safety gates and the lower gates is regulated by a culvert called the T culvert, and is usually in communication with the lock chamber, but may be shut off from it by a valve in the culvert. When the upper lock is at the low level and the valves are opened there is a sudden drop of the water level in the forebay. This is naturally more noticeable at Pedro Miguel, where the canal above the forebay is relatively narrow, than it is at Gatun or Miraflores, where the forebay opens immediately into a lake. This drop is faster than can be followed by the water in the space between the guard and upper gates, and the result is a reverse head on the guard gates, which causes them to open slightly at the miter. This reverse head lasts for only a short time.

When the valves in the side culvert are raised and the water enters the lock, it is evident to the eye that the flow of water is greater



PEDRO MIGUEL LOCK. EAST CHAMBER, LOOKING NORTH. ALL VALVES IN EAST WALL FULLY OPEN. FEBRUARY 21, 1914.



PEDRO MIGUEL LOCK. EAST CHAMBER, LOOKING NORTH. DISCHARGE SHOWING COMPLETE FROM THE ELEVEN CULVERTS OF EAST WALL. FEBRUARY 21, 1914.

through those openings in the laterals which are nearest the middle wall than it is through those nearer the side culvert. The velocity of the water as it pours out of the side culvert into the lateral culverts evidently causes the stream to pass the first few openings in the laterals without giving them their full share of the discharge. As the water rises in greatest volume next the middle wall, there results a slight slope of the surface toward the side wall; but this is not marked enough to cause trouble, and disappears when both side and middle culverts are used. Plates Nos. 1 and 2 illustrate filling with the side culvert only.

It is not so plain that the side culvert discharges more water into the lowest lateral than it does into the higher ones. The first gush of water is always seen to come from the highest lateral, about one minute after the first motion of the valve; then successively from the others; but the amount of flow is not uniformly stronger from one lateral than from another. At some instants of filling one lateral may seem to give a greater discharge than the others, but it will not be the same lateral all the time. During the same filling the most violent discharge may seem at one instant to come from the lateral nearest the valve; at another from the one farthest from the valve, and at a third from some intermediate lateral. The observed facts do not justify a statement that the discharge is uniformly greatest from any one of the laterals.

In the first lockages the T culvert regulating the space between the safety and lower gates was in free communication with the side-wall culvert near its lower end, but above the lower valves. When the upper valves were raised, the water in the space between these gates rose in level somewhat faster than in the lock. There was consequently a reverse pressure on the safety gates, causing them to open at the miter, this pressure being sufficiently great to compress the springs in the gate-maneuvering struts to their full extent. As there may be danger of crippling the moving apparatus by such reverse stress, the valve in the T culvert was partially closed, choking the communication between the side-wall culvert and the space between the gates. By making several adjustments, a degree of closure was reached which caused the water in the space between the culverts to lag behind the water in the lock when filling and, at the same time, to fall rather more rapidly when emptying. In this way a positive pressure was always kept against the safety gates. This, however, was done when the side-wall culvert only was used. A different adjustment will have to be made when both culverts are used, as the rapidity with which the water level in the lock changes is then greatly increased. A more convenient way of avoiding difficulties will probably be found by opening the safety gates after the tow is fast in the lock and just at the time of opening the valves for filling or emptying. If this be done, all necessity for regulating the levels of the space between the gates will cease.

In filling or emptying a small canal lock the water levels approach each other with a rapidity depending upon the square root of the diminishing head. Toward the end of the operation the change in level becomes more slow, and the flow of water is supposed to cease either just before or at equalization of the levels. Frequently the gates are opened with a very slight head against them, to avoid the loss of time involved in waiting for the head to vanish entirely.

In filling or emptying one of the locks of The Panama Canal, different phenomena are noted. In practically all cases there is a noticeable overtravel of the water, so that the water in the chamber which is filled rises slightly higher than the level in the chamber from which the water is drawn, and the gates separating the two chambers become subjected to a reverse head. Thus, taking, for example, the filling of the Pedro Miguel Lock: The water level in the chamber, instead of ceasing to rise when it reaches the level of the water in the forebay, may rise from 0.3 foot to 0.6 foot higher than that level, tending to throw the upper gates open. This head wears itself out soon, but is very noticeable while it lasts, and may be utilized as an indication of the instant when the opening mechanism should be put in operation. It is due to a local surge or overtravel of the water in swift motion in the culverts, and should not be confounded with the wave due to the current set up in the canal. (See plate No. 4.) The latter wave is much longer. The rise due to it reaches its maximum about one hour after the valve has been opened, while the rise which causes back pressure to open the gate leaves appears at once, after equalization of the levels; or in, say, from 8 to 17 minutes, according to the number of culverts and valves which are used.

It will be remembered that certain particular precautions, which are described in pages 85 to 99 of the Annual Report of the Isthmian Canal Commission for 1911, were taken to overcome difficulties attendant upon the difference of density in the water above and below the lower gates of the lower lock, both at Miraflores and Gatun, where the lock flights separate fresh from salt water. It was demonstrated in theory that, with the culverts placed as originally planned, this difference in density would cause the flow through the culverts in emptying the lock to cease before the level in the lock should be equalized with that of the sea; that there would remain a resultant positive pressure against the lock gates, and that it might be impracticable to move them. To avoid this danger the culverts were turned up at their outer end to bring the discharge to the position at which this resultant pressure would reduce to a manageable quantity, according to the theory. It is very possible that the overtravel of the water from the emptying lock into the tail-bay, hereinbefore noted, may result in continuing the flow of the fresh water through the culvert beyond the point at which, in theory, it should cease, and, therefore, in obviating the danger of the resultant pressure, apprehension of which caused the change in the form of the discharge end to be made. At all events, with the design adopted, no trouble is experienced from the remaining pressure against the lower gates after equalization. It is found practicable to maneuver the lower gates without hindrance from that cause. Whether this result be due to the precautions taken in the design, or whether these precautions were really unnecessary, because of the then unsuspected overtravel of the water, can not now be determined.

Certain phenomena which are noteworthy do take place, and are attributable to the difference of density of the water above and below the lower barriers. When the lower lock at Gatun or Miraflores is equalized with the sea, the water which it contains, which is in a

large part drawn from the lake above, is necessarily lighter than the sea water below, which has practically full salinity. After equalization of levels through the culverts the gates still separate the fresh and the salt water, and prevent immediate union. When the lower gates are opened, however, the fresh water rushes out with a considerable velocity on the surface of the salt water below, this outrush of the upper strata being accompanied by a corresponding inrush of the salt water of the lower strata. This current continues for several minutes. It has a noticeable effect on vessels leaving the lock, forcing them out and causing them to take a shear away from the middle wall as soon as they pass the angle of the side wall, where the relatively narrow tail-bay begins to widen out into the broader part of the canal below the lock.

Plate No. 111 is a graphical representative of observations showing the intensity and duration of this current. The manner of making the observations is quoted below from a report of the chief hydrographer, under date of April 20, 1914:

To determine direction of currents between surface of water and El. —15 feet, blades suspended from floats were used. Below El. —20 an instrument was needed which could be held rigid and which would indicate any change in direction. A vane 10 inches wide along one-half its length, a $\frac{1}{2}$ -inch iron rod forming the other half was fixed at center, at right angles to a vertical rod which extended through a sleeve to a point above water. Here a pointer was fixed parallel to the vane. The sleeve in which the vertical rod turned was guyed to the lock walls in such a manner as to facilitate raising and lowering the entire instrument, thus putting the vane into play at any desired elevation, leaving the pointer to be observed at a point above water about 75 feet out from the lower operating gates. (See sketch on curve chart.)

To determine the velocities of currents at different elevations, four current meters were mounted 10 feet apart on a $\frac{3}{4}$ -inch pipe, which was supported vertically in the center of the lock at a point about 10 feet in from the direction indicator. (See sketch on curve chart.) Raising and lowering was provided for similar to direction indicator supports. For convenience we will speak of the uppermost meter as No. 783, the second below surface as No. 732, the third as No. 211, and the lowest as No. 377. The time intervals between readings of these meters varies with the type of instrument from 10 seconds to 1 minute, and the velocities given as results of each run are average values calculated from readings taken during that run. Time referred to of opening and closing miter gates begins with first cracking of gates and ends with tight joining. In each case gates were opened full, allowed to remain open for about 30 minutes, then closed. The lower guard gates remained open full during all test runs.

Run No. 1: Tide —2.6'; falling.

Meters: No. 783 at El. —7.5'; No. 732 at El. —17.5'.

No. 211 at El. —27.5'; No. 377 at El. —37.5'.

Direction indicator at El. —37.5'.

The flow of water through the culvert from the lock chamber to sea, in equalizing, caused the direction-indicator vane to fluctuate rapidly, due to eddies set up. This was reassuring with respect to adaptability of the instrument.

Lower operating gates opened at 2.36 p. m.; closed at 2.52 p. m.

Direction of current at El. —5.0' and —10.0', out.

“ “ “ “ —37.5', in (toward locks).

Average velocities “ “ —7.5', 2.0' per sec.

“ “ —17.5'. Meter not recording, due to effect of salt water on contact points.

“ “ —27.5', 1.06' per sec.

“ “ —37.5', 1.66' “ “

Run No. 2: Tide +1.4; rising.

Meters: No. 783 at El. —5.0'; No. 732 at El. —15.0'.

No. 211 at El. —25.0'; No. 377 at El. —35.0'.

Vane of direction indicator at El. —30.0'.

Lower operating gates opened at 9.18 a. m.; closed at 9.45 a. m.

Direction of current at El. —5.0' and —10.0', out.

" " " " " —30.0', in.

Average velocities at El. —5.0', 1.79' per sec.

" " —15.0', 1.85' " "

" " —25.0', 0.5' " "

" " —35.0', 2.04' " "

Run No. 3: Time +2.3; falling.

Meters: No. 783 at El. —5.0'; No. 732 at El. —15.0'.

No. 211 at El. —25.0'; No. 377 at El. —35.0'.

Indicator vane at El. —25.0'.

Lower operating gates opened at 2.06 p. m.; closed at 2.35 p. m.

Direction of currents at El. —5.0' and —10.0', out.

" " " " " —25.0', in.

Average velocities at El. —5.0', 1.77' per sec.

" " —15.0'. Meter not working, due to effect
of salt water on contact points.

" " —25.0', 0.61' per sec.

" " —35.0', 1.89' " "

Run No. 4: Tide —2.2; falling.

Meters: No. 783 at El. —3.0'; No. 732 at El. —13.0'.

No. 211 at El. —23.0'; No. 377 at El. —35.0'.

Indicator vane at El. —20.0'.

Lower operating gates opened at 4.23 p. m.; closed at 4.54 p. m.

Direction of currents at El. —5.0' and —10.0', out.

" " " " " —20.0', out.

Average velocities at El. —3.0', 1.56' per sec.

" " —13.0', 1.58' " "

" " —23.0', 0.89' " "

" " —33.0', 1.28' " "

Run No. 5: Tide —0.3'; rising.

Meters: No. 783 at El. —2.0'; No. 732 at El. —12.0'.

No. 211 at El. —22.0'; No. 377 at El. —32.0'.

Indicator vane at El. —25.0'.

Lower operating gates opened at 9.26 a. m.; closed at 9.58 a. m.

Direction of currents at El. —5.0' and —10.0', out.

" " " " " —25.0', out.

Average velocities at El. —2.0', 1.65' per sec.

" " —12.0', 1.71' " "

" " —22.0', 0.75' " "

" " —32.0', 1.08' " "

Run No. 6: Tide +4.7; rising.

Meters: No. 783 at El. —3.0'; No. 732 at El. —13.0'.

No. 211 at El. —23.0'; No. 377 at El. —33.0'.

Indicator vane at El. —25.0'.

Lower operating gates opened at 11.40 a. m.; closed at 12.05 p. m.

Direction of currents at El. —5.0' and —10.0', out.

" " " " " —25.0', in.

Average velocities at El. —3.0', 1.60' per sec.

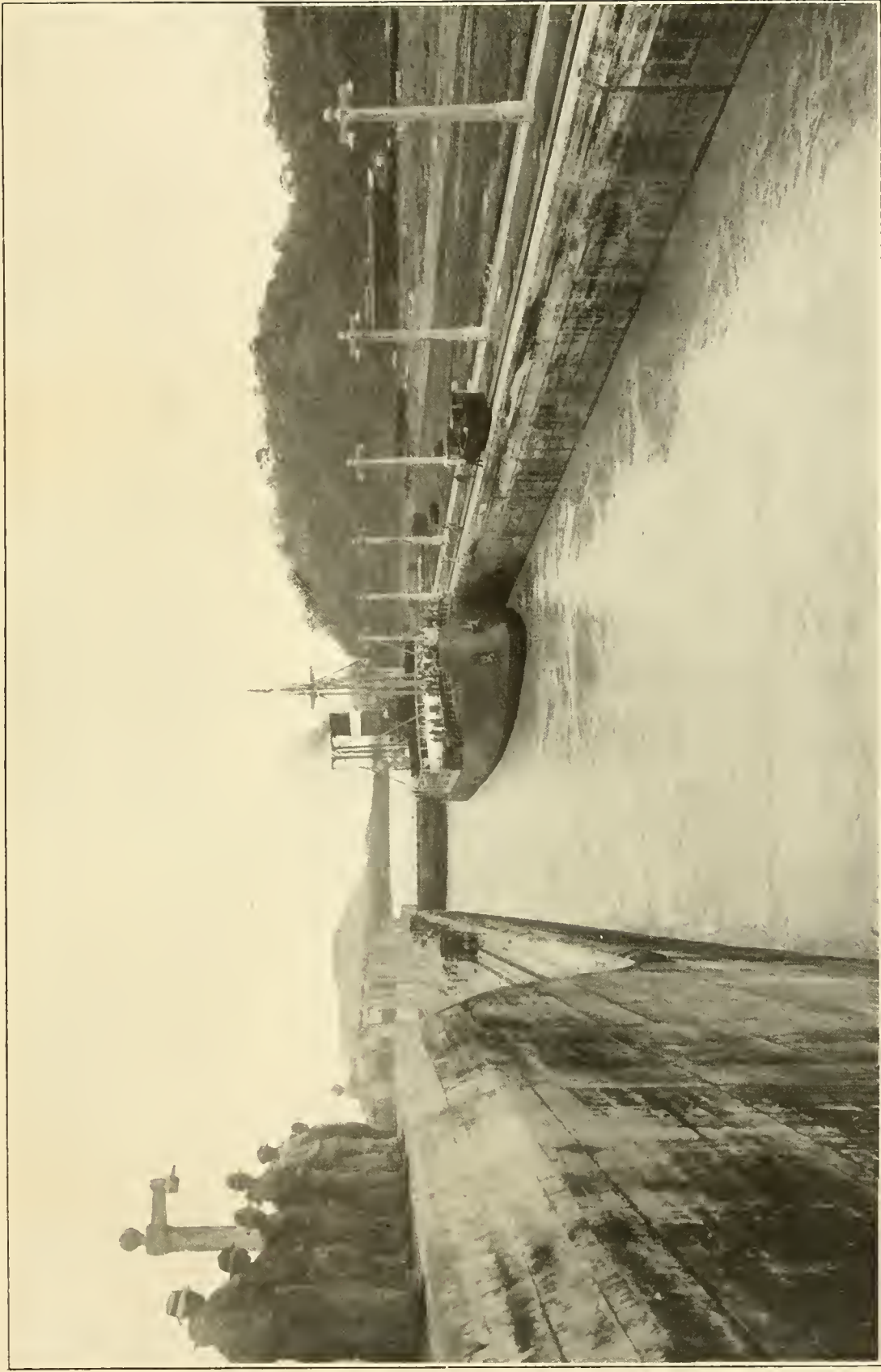
" " —13.0', 1.53' " "

" " —23.0', 0.27' " "

" " —33.0', 1.46' " "

On a vertical base line, velocity in, is plotted to right and velocity out, to left. The vertical depth from mean sea level to El. —50 or floor of lock is the ordinate: for instance, in run No. 1, the direction of current determined by float is out, at El. —7.5, and velocity at this elevation is 2' per second. Therefore, going down the vertical base line from 0 to —7.5 and horizontally to left, the point on the curve is struck. These six curves show that at some point between El. —20 and —30 the velocity is zero. In runs Nos. 1, 2, 3 and 6, this neutral point is about El. —24 and in Nos. 4 and 5 a little lower.

For runs Nos. 5 and 6, which are typical, time intervals of one minute are plotted left to right; feet per second, velocity at each minute is plotted up



OPERATION OF MIRAFLORES LOCKS. S. S. "SANTA CLARA" IN LOWER WEST CHAMBER, LOCK FILLING. LOOKING SOUTH.
JUNE 18, 1914.



OPERATION OF MIRAFLORES LOCKS. S. S. "SANTA CLARA" IN UPPER WEST CHAMBER, LOCK FILLING. LOOKING SOUTH.
JUNE 18, 1914.

when direction is out and down when direction is in. It has been assumed from the test runs, that at a given elevation, the direction of current is the same for all operations of gates, and this assumption was used in plotting curves. It will be noted in comparing these curves for runs Nos. 5 and 6 that meter No. 211 in run No. 5 at El. -22 shows a velocity running above 0.6' per second out. But, in run No. 6, with meter 211 at -23, which is nearer the neutral point shown by the curves of the six tests, the velocity is less than in run No. 5 and drops to zero in four readings. This substantiates the results obtained with respect to the elevation of the point of zero velocity.

Another manifestation, which is probably due in some way to the combination of fresh and salt water, is to be found in the lower lock after the lower gates have been opened for some time, and the water in the lock has assumed full salinity. When the lock is then equalized with the one above by using the side-wall culvert only, the draw away from the middle wall, which has already been referred to as observable in all the locks when filled from the side culvert, is much more marked than it is in the other locks. It is not practicable for the towing locomotives to hold a large vessel central in the lower lock when it is thus filled, during the entire process of filling. The vessel is drawn over toward the side wall with a force sufficient to cause the slip drums of the towing locomotives to yield and the towing lines to pay out until the vessel comes to rest against the side wall. While the draw away from the middle wall is to be found in the other locks as well, when filled from the side wall, it is perfectly practicable, except in the case of these two locks, for the towing locomotives to hold the tow central, but in the case of the two lower locks this is, as stated, impracticable. The matter is referred to as being curious, but by no means serious; for if both culverts are used no trouble is experienced, and if it is desired to use only the side-wall culvert, all difficulty may be avoided by mooring the vessel against the side wall before operating the valves. Plate No. 3 illustrates the effect in the lower lock, and plate No. 4 the absence of the effect in the upper lock.

When the operating valves of the locks were designed it was intended that the time of filling or emptying the 900-foot lock should not exceed 15 minutes with both culverts. The coefficient of flow, C , which is applied to the theoretical velocity due to the head, in order to determine the real velocity, was assumed at 0.65, this being slightly more favorable than experience at other locks has shown to be readily attainable. It was believed that the large size of the culverts, and the care which was taken to round the entrances, would justify the assumption of a more than usually favorable value. The arrangement of the culverts and valves is the same in principle in all of the locks of The Panama Canal, but the admission is easier in the upper lock and the discharge in the lower lock of a lift than in the intermediate ones. It was thought for the purpose of the design to be sufficiently accurate to assume an average value of the coefficient for all conditions. The time of operation was then calculated as dependent upon the flow through the most restricted area of the culvert section. The accompanying plate, No. 71, shows diagrammatically the variations in area of the waterway through which the flow must pass in filling the upper lock of any of the lock flights. It may be seen that when both valves in the side-wall culvert are used the most restricted section is in the culvert itself, with

area of 255 square feet, and that when one valve only is used the most restricted section is at the valve, with an area of 144 square feet. The same is the case with respect to the middle wall.

Plate No. 72 shows observations taken at the time of filling the 900-foot lock at Pedro Miguel. This being the case of a lock chamber filled from a pool of unchanging level, the formula for the time of filling is:

$$T = \frac{2A(\sqrt{H} - \sqrt{h})}{C \times a \times \sqrt{2g}}$$

in which A is the area of the lock=123,000 square feet; a is the area of the culvert taken at its most restricted point; H is the original difference in level of the pools to be equalized; h is the final difference in level, being zero at actual equalization; T is the time consumed, in seconds; C is the coefficient of flow, and g is the acceleration due to gravity. The curve in Plate No. 72 shows the rise of water in the lock after the valves were first moved. Both valves of the pair were raised simultaneously but, as it takes 1 minute for the valves to open, the full area of the culvert was not available for flow until about 1 minute from the time of starting. The true value of the coefficient C should therefore be calculated for the portion of the curve beginning, in time, 1 minute from the first application of the power, and in height, at the level which the water in the lock had reached at the expiration of 1 minute.

At the time of the experiment the lake was at reference 84.8, and the water in the lock at reference 50.9. The time which elapsed from the first application of the power to the creation of back pressure on the upper gates (Nos. 54 and 55), which caused them to open, was 12.5 minutes, but the water in the lock did not reach the level of the upper pool for 14 minutes. During this time the water in the lock rose from 50.9 to 84. During the first minute of the time, however, the full area of the culvert was not available, and during this minute the water in the lock rose from 50.9 to 51.7. We have, therefore, for use in the formula to determine the value of C applicable to established flow, the values:

$$H = 84.8 - 51.7 = 33.1$$

$$h = 84.8 - 84.8 = .0'$$

$$T = 14.0 - 1 = 13.0m$$

We have, therefore—

$$C = \frac{2 \times 123,000 \times (\sqrt{33.1})}{13.0 \times 60 \times 255 \times \sqrt{64.4}}$$

whence—

$$C = C = 0.886$$

The coefficient is therefore much more favorable than was anticipated.

It would appear from theory that C should be constant for any point of the curve, or for the entire operation of filling the lock. Examination of the observations, however, will show that this is not exactly true. In the first part of the operation the lock fills from 51.7 to 70 in 4.6 minutes, for which part of the operation C is found to be 0.830. In the latter part of the filling the level rises from 70

to 84 in 6.9 minutes. For this point of the operation $C=0.858$. It appears, therefore, that the coefficient increases in value toward the end of the filling, after steady flow in the culvert has been established. The plate shows, also, that after the spontaneous opening of leaves 54 and 55 the water in the lock continued to rise until it reached level 85, or 0.2 foot above the original lake level, and 1 foot above the level at which the upper gates cracked, due to reverse pressure. This rise is apparently occasioned by the local overtravel of the water in the culverts. The rise caused by the general wave set up in the canal (plate No. 74) is greater in amplitude and does not reach its full height until about 48 minutes later, or about 1 hour after raising the valves.

In plate No. 73 is shown the curve of observations for the filling of Pedro Miguel lock through the side culvert, using only one valve instead of two. In this case the most restricted area of the waterway is at the valve instead of in the main culvert, and is, therefore, 144 square feet instead of 255 square feet. The natural assumption is that the time of filling will be increased in length over that observed in the first experiment in the direct ratio of $\frac{255}{144}$, assuming the head to be the same in both cases. The observed time, however, is much less. When the observations were taken the water above was 84.8 and in the lock at 51.5. The observed interval T^n from the first movement of the valve until the water reached the level 84.9 was 18 minutes. As before, it took 1 minute to raise the valve from an opening 0 to one of 144 square feet. This time may be omitted, as well as the corresponding rise of water in the lock, from 51.5 to 53. We have, therefore—

$$H = 84.8 - 53 = 31.8$$

$$h = 84.8 - 84.8 = 0.0$$

$$T = 17.0 \text{ minutes}$$

Whence—

$$C = \frac{2 \times 123 \times (\sqrt{31.8})}{17 \times 60 \times 144 \times \sqrt{2g}} = 1.177$$

i. e., the coefficient C applied to the most restricted section of the culvert is greater than unity. In this section, therefore, the water at any instant is flowing with a velocity greater than that due to the head existing at that instant. Examination of the curve will show that the coefficient is slightly more favorable near the end of the operation than near the beginning, as was the case when both valves were used.

The result of the trial just described was so remarkable that similar observations, using only one valve, were made in the upper lock at Gatun, as a check on those at Pedro Miguel. It was found there that with the lake at 84.9 and the lock at 55.2, the upper gates cracked at a level of 84.9, 16 minutes after the valve started to rise. During the time when the valve was opening and the culvert area increasing from 0 to 144 square feet, the water in the lock rose from 55.2 to 56. We have, therefore—

$$H = 84.9 - 56.0 = 29.9$$

$$h = 0$$

$$T = 16 - 1 = 15 \text{ minutes}$$

$$C = 1.272$$

or even more favorable than the value derived from Pedro Miguel. This is doubtless to be accounted for by the fact that the access of water to the filling culverts at Pedro Miguel is through the relatively narrow canal prism, while at Gatun the flow is derived directly from the relatively large lake area. The drop in the forebay at Pedro Miguel when the filling valve is opened, is much greater than it is at Gatun, and the head is diminished by this drop throughout the greater part of the time of filling.

When the equalization of levels takes place between two lock chambers rather than between one of the terminal pools and the next lock, the water levels in both chambers change progressively during the operation instead of one remaining stationary and the other rising or falling, as is the case when equalizing with one of the terminal pools. The case is that of two locks in a flight, the original difference in level being the sum of the lifts of the two locks. The formula for the time consumed in the operation is as follows:

$$T = \frac{2AA^1}{(A + A^1)} \times \frac{(\sqrt{H} - \sqrt{h})}{CA\sqrt{2g}}$$

in which A and A^1 are the area of the locks in horizontal plane. H is the original difference in level, and the other quantities are the same as before.

In several observations taken at Gatun and Miraflores it has been found that the value of C , for equalization between two consecutive locks with only the side culvert, is less than that for filling the upper lock. Values from 0.60 to 0.68 have been observed. The operation, however, is gratifyingly rapid. It ordinarily takes about $12\frac{1}{2}$ minutes to equalize two of the locks in the Gatun flight when the original difference in level of the two pools is about 56 feet, and the side culvert only is used.

At Pedro Miguel the value of the coefficient for emptying the lock is somewhat less favorable than it is for filling. In this lock the culvert empties into the tail-bay, with its axis horizontal. The coefficient C for the side culvert is found to be 0.804 when both valves are used.

At Miraflores and Gatun the culvert was turned upward at its discharge, the opening being in a horizontal plane instead of a vertical plane. Interference with the flow is to be expected on account of this change of direction. This, however, is not serious. Observations thus far taken indicate that the coefficient of flow through the upturned discharge is about 8 per cent less than that through the level discharge of Pedro Miguel.

When the middle-wall culvert is used in combination with the side culvert, the time of operation is greatly reduced. Trial with the middle culverts has not yet been made at Gatun and Miraflores, but at Pedro Miguel the lock can be filled or emptied in about 8 minutes without creating too great disturbance in the chamber. In doing this, both culverts are not allowed to flow to their full capacity through the first part of the lockage, the usual manipulation being to raise one valve in each culvert and to allow the water to flow thus for 3 or 4 minutes before raising the other two valves.

The value for the coefficient C in the middle culvert is less favorable than it is in the side culvert. This is due undoubtedly to a

certain cramping of the flow through the cylindrical valves. A sufficient number of observations has not yet been taken to enable this value to be stated with accuracy.

Above the upper lock gates at Pedro Miguel the prism of the canal was made 600 feet wide, narrowing to its normal width of 300 feet at a point 3,400 feet to the northward. This was done in order to make a basin from which the water should be drawn for filling the lock, it being hoped in this manner to reduce the surge or oscillation which must take place in the canal above the lock as a result of drawing off the large volume of water necessary to fill the lock chamber. While the surges are still noticeable, they are not of serious moment. Plate No. 74 indicates the oscillation of the water level at the gauge just above Pedro Miguel gates, due to the operation of filling the lock, using only one culvert. Plate No. 75 shows the same when two culverts are used. The effect of a lockage at Pedro Miguel is noticeable at the observation station at Juan Mina, a distance about 5 miles up the Chagres River from Gamboa, or about 13 miles from Pedro Miguel Lock.

EMERGENCY DAMS.

Dams A and B at Gatun were completed before the end of the last fiscal year, but the final acceptance tests had not been finished. During the fiscal year the two dams at Gatun were accepted as complete, and the dams at Pedro Miguel and Miraflores were finished and accepted, the dates of completion being as follows:

Pedro Miguel.—Dam C, September 16, 1913; Dam D, October 17, 1913.

Miraflores.—Dam E, February 7, 1914; Dam F, January 14, 1914.

Dam A, the east dam at Gatun, was subjected to test in May, 1914, to ascertain how much water would pass through it under the full head. The dam was swung, girders and gates lowered, and the pipes driven to close the spaces between the ends of the gates; the upper lock was then filled with water to lake level, the upper guard gates and upper operating gates were opened, with the intermediate and lower gates of the lock closed, and the upper lock was emptied through the culverts until the water level was below the guard-gate sill. This brought the full head of $47\frac{2}{3}$ feet on the emergency dam, which was found to have a leakage of 950 cubic feet per second. This leakage produced no dangerous current in the lock, and it would have been quite easy to close any of the lower gates in the face of the stream. Details of the experiment will be found in the report of the electrical and mechanical engineer, Appendix A-1.

The work of the emergency dam subdivision having ended, the force was disbanded or merged with the division of erection in January, 1914.

ELECTRICAL DIVISION.

This division was organized on April 1, 1914, under the supervision of Capt. William H. Rose, electrical engineer, assisted by Mr. Hartley Rowe, electrical superintendent. The duties comprise all which had prior to that date been performed by the electrical subdivision of the mechanical division. They include the operation and maintenance of the steam-driven electric-power plants at Gatun,

Miraflores, Empire, and Balboa, and of all substations, transmission, and distribution lines connected with these power plants; the operation and maintenance of the air-compressor plants at Empire and Balboa; the construction, operation, and maintenance of all building and street-lighting systems on the Canal Zone, except the lighting in the permanent concrete buildings under construction at Balboa and other points; the operation and maintenance of the electric cargo-handling cranes on the Panama Railroad pier at Balboa; the installation, operation, and maintenance and repair of electrical apparatus of all kinds upon request of all other departments and divisions; the installation of all electrical equipment in the new Balboa shops of the mechanical division; the construction of permanent underground conduit systems for the permanent towns of the Canal Zone.

In addition to the duties above mentioned, the electrical division is charged with the design of overhead and underground distribution system for light and power for all towns, and of all street, yard, wharf, and pier lighting systems, and on April 16, the design and construction work in connection with the lighting and power installations in the permanent concrete buildings being erected by the supply department was assigned to the electrical division. The operation and maintenance of the hydroelectric station at Gatun and of the substations, transmission and distribution lines connected with it when these structures should be completed by the division of erection, were also assigned to the electrical division.

DIVISION OFFICE AND DESIGNING FORCE.

The following summary shows the work performed by the designing force of the electrical division between April 1 and the close of the fiscal year:

- Preparation of plans for underground conduit system for the Ancon-Balboa district.

- Preparation of wiring plans for the following permanent buildings: Two-family quarters (two story), Balboa fire station and commissary warehouse at Cristobal.

- Preparation of wiring plans for the various buildings at the Colon, Darien, and Balboa radio stations.

- Preparations of plans for the revised feeder layout for Balboa shops.

The drafting force also assisted in the inspection of work in the field, checking electrical material as it arrived, and contractors' drawings, preparing requisitions and specifications, etc.

OPERATION OF POWER PLANTS.

The new hydroelectric station at Gatun, with the exception of generating unit No. 3, was turned over on June 18, 1914, by the division of erection to the electrical division, but the requisite adjustments of instruments, governors, etc., had not been completed by the end of the fiscal year to a degree that would permit of the station being operated regularly under load.

The operation of the steam stations at Gatun, Miraflores, Empire, and Balboa was conducted satisfactorily during the year. One of the three 1,500-kilowatt vertical turbo-generator sets and two 410-horsepower water-tube boilers were removed from the Gatun station for installation in the Miraflores station. The work of setting up the new unit was completed about June 1, 1914. This change

gives the Miraflores plant a nominal capacity of 6,000 kilowatts, the same as that of the hydroelectric station. The capacity of the Gatun plant is decreased to 3,000 kilowatts, which will be sufficient to carry the load at the Atlantic end of the canal, including the Gatun locks, Cristobal coaling plant, pumping plants at Mount Hope and Agua Clara, and the lighting at Gatun, Cristobal, and Colon, in case of simultaneous breakdown of the hydroelectric station and the transmission line.

The following table shows the monthly net outputs of the various stations during the year:

Date.	Steam-power plants.				Hydro-electric.
	Gatun.	Miraflores.	Empire.	Balboa.	Gatun.
1913.					
July.....	684,000	1,056,620	216,070	7,920	.....
August.....	643,885	1,102,730	250,590	7,152	.....
September.....	564,310	1,132,660	253,240	14,385	.....
October.....	679,295	1,145,470	257,340	14,599	.....
November.....	579,830	989,330	246,170	24,702	.....
December.....	520,485	1,308,440	227,130	15,372	.....
1914.					
January.....	428,180	1,514,880	213,250	15,388	.....
February.....	550,279	1,300,926	176,855	9,784	.....
March.....	387,670	1,550,926	179,288	6,733	.....
April.....	550,912	1,702,400	104,074	6,621	.....
May.....	624,360	1,785,260	100,840	7,302	.....
June.....	611,350	1,763,090	103,030	8,185	6,800
Total.....	6,824,556	16,352,732	2,327,877	138,143	6,800

OPERATION OF AIR-COMPRESSOR PLANTS.

The air-compressor plants at Empire and Balboa were operated satisfactorily throughout the year. The Rio Grande plant was operated until November 1, 1913. These plants furnished compressed air for the excavation work in the Culebra, Rio Grande, and Gold Hill districts; for the mechanical division shops at Empire, Paraiso, and Balboa, for the work of the division of erection at Pedro Miguel Locks, for Ancon quarry, for the excavation work at Sosa Hill, and the new dry dock at Balboa, for the construction of the new piers and other terminal improvements at Balboa; and for numerous pumps, drills, etc., operated by the various divisions for miscellaneous purposes. The following table shows the monthly outputs of the air-compressor plants in cubic feet of free air compressed to 105 pounds gauge pressure:

Date.	Balboa.	Empire.	Rio Grande.
1913.			
July.....	209,019,804	388,035,225	117,895,507
August.....	209,765,100	388,327,930	124,460,160
September.....	218,536,374	347,860,851	97,385,875
October.....	246,344,822	298,022,738	32,651,970
November.....	210,957,449	271,020,215	.....
December.....	230,404,631	264,990,365	.....
1914.			
January.....	206,072,221	223,584,387	.....
February.....	177,495,119	197,125,282	.....
March.....	200,067,047	234,325,285	.....
April.....	228,568,806	146,215,121	.....
May.....	290,288,650	85,533,309	.....
June.....	312,030,510	63,859,454	.....
Total.....	2,739,650,533	2,908,900,165	372,333,512

In addition to the above the electrical division and its predecessors operated a steam-driven air compressor at Gatun for the division of erection, and also the motor-driven air compressors at Gatun locks and Miraflores locks, which were transferred to The Panama Canal from the McClintic-Marshall Construction Co.

MAINTENANCE OF BUILDING AND STREET LIGHTING SYSTEMS.

The usual maintenance and repair work in connection with house and street lighting systems, lamp renewals, etc., in all buildings and towns on the Canal Zone was done during the year.

A large amount of wiring work was involved in the taking down of wooden quarters and other buildings in the various towns in the Canal Zone, and their removal to and reerection in the Ancon-Balboa district. A total of 178 buildings had their wiring and fixtures removed, and were later rewired on account of such moves during the fiscal year.

TRANSMISSION AND DISTRIBUTION LINE CONSTRUCTION AND MAINTENANCE WORK.

The removal of the shops from Gorgona, Las Cascadas, and Empire and the erection of the new shops at Balboa, together with the great increase in the electrical load at the latter place, due to the concentration of construction work in that vicinity, necessitated a large amount of heavy pole line work during the year.

In February, 1914, two temporary substations were completed, one at the Miraflores power plant and one at Balboa, each of 1,500 kilowatt capacity for 11,000-volt transmission between these two places. A wooden pole transmission line carrying three No. 4/0 three-phase circuits was constructed, one circuit being used for the 11,000-volt line and two circuits for 2,200-volt lines. By June, 1914, these circuits were loaded to capacity, and the 11,000-volt line was transferred to the west side of the new permanent transmission line, so as to release an additional 4/0 line for 2,200-volt transmission.

In May, 1912, another 11,000-volt transmission line with 1,500 kilowatt transformer installations at each end was completed between Miraflores power plant and Cucaracha for the supply of power to the relay pump of the dredging division at Cucaracha slide and to the booster pumps at the Gold Hill hydraulic plant.

Various other pole line additions and alterations were made, and in all the pole line construction during the fiscal year amounted to about 15 miles. About 25 miles of pole line for the supply of power to the range lights and beacons of the lighthouse subdivision were constructed during the year, the lighthouse subdivision erecting the poles and the electrical division installing the wire and transformers and connections to the lights and beacons.

Duplicate 2,200-volt armored cables for the supply of power to Agua Clara pumping station were installed between that station and Gatun substation.

An underground 4-duct conduit line 1,400 feet long was built at Pedro Miguel, connecting the new telephone exchange at that place with a manhole of the main conduit line from Miraflores substation to Pedro Miguel Locks.

An 8-duct bitumenized fiber conduit line with concrete manholes was constructed from a point near the Tivoli Hotel to the new administration building at Ancon, and a 12-duct line from the latter point to the new Balboa substation was practically completed. The construction of another 8-duct line from the substation to supply the new town site at Balboa was begun. In all, 12,900 feet of conduit, having 83,000 feet of duct incased in concrete and 40 concrete manholes were completed during the fiscal year.

ELECTRICAL WORK IN PERMANENT BUILDINGS.

The electrical work in permanent buildings that was done during the fiscal year comprised the light and power wiring, installation of metal conduit, panel boards, fixtures, etc., in the new administration building at Ancon, 20 concrete 4-family quarters at Balboa, and the Ancon commissary building. On June 30 the work in the new administration building was approximately 90 per cent completed, the twenty 4-family quarters 55 per cent, and the Ancon commissary 99 per cent completed. In connection with this work 108,900 feet of metal conduit of all kinds were installed, 5,250 outlets, and 48,100 feet of wire.

ELECTRICAL WORK IN NEW BALBOA SHOPS.

This work comprised the removal of the electrical equipment in the shops at Gorgona, Las Cascadas, and Empire, and its installation in the new shops at Balboa, together with such new apparatus as was required. On account of the necessity for making these changes with the minimum disturbance to the work of the shops, extensive temporary installations of lighting and power circuits, motors, etc., had to be made in practically every building. There are in all 28 buildings in the Balboa shops group. The permanent electrical work includes the installation of the following:

199 motors, having an aggregate capacity of 2,278 horsepower.

10 power transformers having an aggregate capacity of 2,550 kilowatt volt amperes.

7 lighting transformers having an aggregate capacity of 400 kilowatt volt amperes.

31,100 feet of lead-covered cable, ranging in size from No. 6 to 750,000 circular mils.

247,660 feet of wire.

95,000 feet of metal conduit, ranging in size from $\frac{1}{4}$ -inch to $3\frac{1}{2}$ -inches.

309 receptacle outlets.

2,218 incandescent lamps varying in size from 40 watts to 500 watts.

99 junction and panel boxes.

9 switchboards, having in all 24 panels

2 325-kilowatt synchronous motor generator sets.

12 electric traveling cranes, aggregate capacity 327 tons.

1 turntable.

1 transfer table.

Considered as a whole, the electrical work in the new Balboa shops was approximately 80 per cent completed on June 30.

OPERATION AND MAINTENANCE OF ELECTRIC CARGO-HANDLING CRANES.

This work comprises the operation and maintenance of eight 4-ton alternating-current cargo-handling cranes, five 4-ton direct-current cranes, and one 20-ton direct-current French crane, all on the

Panama Railroad pier at Balboa. With the exception of a comparatively small amount of cargo that is handled by ships' tackle, these cranes handle all commercial freight that crosses the Isthmus in either direction. They are operated 17 hours per day—9 hours on the day shift and 8 hours on the night shift. The total number of vessels loaded and unloaded during the year was 413.

MISCELLANEOUS.

In addition to the work outlined above a number of miscellaneous jobs were completed for other divisions and departments.

DIVISION OF MUNICIPAL ENGINEERING.

This division was created July 16, 1913, to take over the duties of the division of public works and the municipal work, which had hitherto been done by the three construction divisions, each under its own jurisdiction. During the year it has been under the immediate charge of Resident Engineer George M. Wells, assisted by Supts. E. H. Chandler and D. E. Wright, and Asst. Engineer W. J. Spalding. It is organized into five principal subdivisions or districts; the northern district in charge of Supt. Chandler; the southern district in charge of Supt. Wright; the waterworks for the southern end of the canal in charge of Asst. Engineer Spalding; the purification plants and water supplies at present in charge of Mr. E. J. Tucker, acting physiologist; and designs under the immediate supervision of the resident engineer, with Asst. Engineer T. G. Morris in charge of the drafting room.

For details of the work accomplished attention is invited to the report of the resident engineer, attached hereto as Appendix A-2. A feature of the report which may be of special interest is the change in plan for the new water supply for the southern end of the canal. It was at first proposed to draw from the Miraflores Lake through a pumping station at the lower end of the Caimito Valley, the water being filtered and treated with hypochlorite of lime at the filtration plant to be built in the near vicinity. After the operations of the Miraflores Locks began in October, 1913, a rise of the chlorine content in Miraflores Lake was noted. It soon reached a point which necessitated measures being taken to relieve the situation, as the boilers in the steam plants depending upon this water supply were in danger. As a measure of immediate relief a temporary pumping station was located on the upper east flare wall of the Pedro Miguel Lock and water was pumped through the existing 16-inch main to the intake of the Miraflores plant. This supply of water from the Culebra Cut reduced the salinity of the distributed water, but increased its turbidity to a marked extent. It was evident that permanent relief must be sought through other means. Accordingly plans have been made to draw the water supply for the Miraflores filtration plant from the Chagres River just above Gamboa bridge. Order has been placed for the material necessary for a pipe line from Gamboa to Miraflores and work on the pumping station at Gamboa is now under way.

The increase of salinity noted in the Miraflores Lake water is most probably due to the salt water climbing up through the lock flight in the process of locking. When an up lockage is made the water in the

upper lock, after it has been filled from Miraflores Lake, contains a considerable proportion of salt water derived from the mixing of the relatively fresh water in the upper lock with the salt water in the lower lock in equalizing levels. When the upper gates are opened the partially salt water escapes into the lake. Through continuous repetitions of this process an equilibrium would finally be established between the fresh-water inflow into the lake and the salt-water contamination through up lockages. Before reaching this equilibrium, however, the salinity of the water would render it entirely unfit for industrial use. It is possible that the chlorine content is in part due to the saturation of its bed by the tidal waters which reached it before the lake was formed, but the increase in salinity, following immediately after the lockages, indicates the latter as the more probable source of contamination.

OFFICE ENGINEER.

The usual routine work of preparing maps, charts, diagrams, etc., for the general office, the compilation of construction statistics, and such special statistics as were required from time to time has been continued during the year. The general map of the canal on a scale of 1/20,000 has been completed so far as the condition of construction work permits, and a sailing chart of the canal has been prepared for the lighthouse division.

During the year the printing force has turned out—blue prints, 518,950 square feet; white prints, 135,593 square feet; brown prints, 21,427 square feet; cloth prints, 590 square feet. The work has been in charge of Mr. A. B. Nichols, office engineer, assisted by Mr. A. Raggi, assistant engineer, and the necessary drafting and clerical force.

SECTION OF METEOROLOGY AND HYDROGRAPHY.

This work has been in charge of Chief Hydrographer F. D. Willson, assisted by Asst. Chief Hydrographer H. G. Cornthwaite and the necessary office and field force. For details of the work performed attention is invited to report attached as Appendix A-3.

Interest attaches to the change in conditions which have been effected during the year by the filling of Gatun and Miraflores Lakes. Between June 27 and December 27, 1913, the Gatun Lake level rose from +48.22 to +84.7; since the latter date it has been controlled by the spillway gates between 85.14 and 84.13. Between October 1 and November 10, 1913, Miraflores Lake was filled from +12 to +51; since November 10 the level has been controlled by the culverts and the spillway gates. Being small, the level of the lake is affected by a single lockage. At the close of the year it was kept at levels varying between 53.5 and 54.5.

DISCHARGE AT THE SPILLWAY.

Measurements of the discharge of the Gatun spillway were made on several occasions during the year. In the design of the spillway the Francis formula $Q = CLH^{3/2}$ was used, in which Q is the quantity discharged over the crest; L = the length of the crest con-

sidered; H = height of water surface in the lake above the crest of the dam; and C = a constant, assumed in the design as 3.2. A mean of 15 measurement taken during the year gave the value $C = 3.58$, indicating that the discharge over the spillway crest will be slightly greater than was contemplated in the design. The spillway was proportioned with the intention that when with the lake level +87 the discharge of each gate should be about 11,000 cubic feet per second.

During the year it has been possible for the first time to determine by observation the velocity which would be caused in the canal prism at Gamboa by floods in the upper Chagres. As yet no large flood has occurred since the Gatun Lake was filled. On May 26, however, with a discharge at Alhajuela of 16,900 feet second, the velocity at Gamboa bridge was 0.653 mile per hour, the lake level being at 84.92 and rising to 84.98. On June 30, with a discharge at Alhajuela of 20,050 feet second, the velocity at Gamboa bridge was 1.05 miles per hour, with the lake at 84.88 to 84.86.

LEAKAGE AT SPILLWAY.

In December before the spillway gates had been operated and in March after several operations of the gates, measurements were made to determine the leakage at Gatun spillway. The mean for the test in March showed an average leakage of 3.65 feet second for 49 hours. The lake level was at about 84.6 during the December measurements and about 84.84 during the March measurements.

Measurements have also been made of the leakage through the Stoney valves in the lock culverts at Gatun. There was shown a leakage through one pair of side-wall valves of about 2.4 feet second under a head of 70.5 feet measured above the bottom of the valves. The leakage of one pair of middle-wall valves was about 3.5 feet second under a head of 60.5 feet.

GENERAL SURVEYS.

The work of the section of general surveys has been in charge of Mr. O. E. Malsbury, assistant engineer, with the necessary force. It consisted in setting corner and grade stakes for 159 building lots in Colon and Panama, setting grades for fill in Colon, and making other surveys for miscellaneous building lots where required; in making surveys and preparing maps of estates and parcels of land in dispute before the joint land commission; in making surveys and inspections of estates and parcels of land for the department of law; in repairing and removing Zone triangulation stations; and making surveys and maps where required for other departments of The Panama Canal organization. Locations were made for the radio stations to be constructed by the Navy Department; readings taken on the settlement hubs in the Gatun Dam; and the necessary work done in connection with the precise level bench marks and monuments for the tide-gauge registers at Colon, Gatun, and Miraflores. A considerable amount of miscellaneous work was also accomplished.

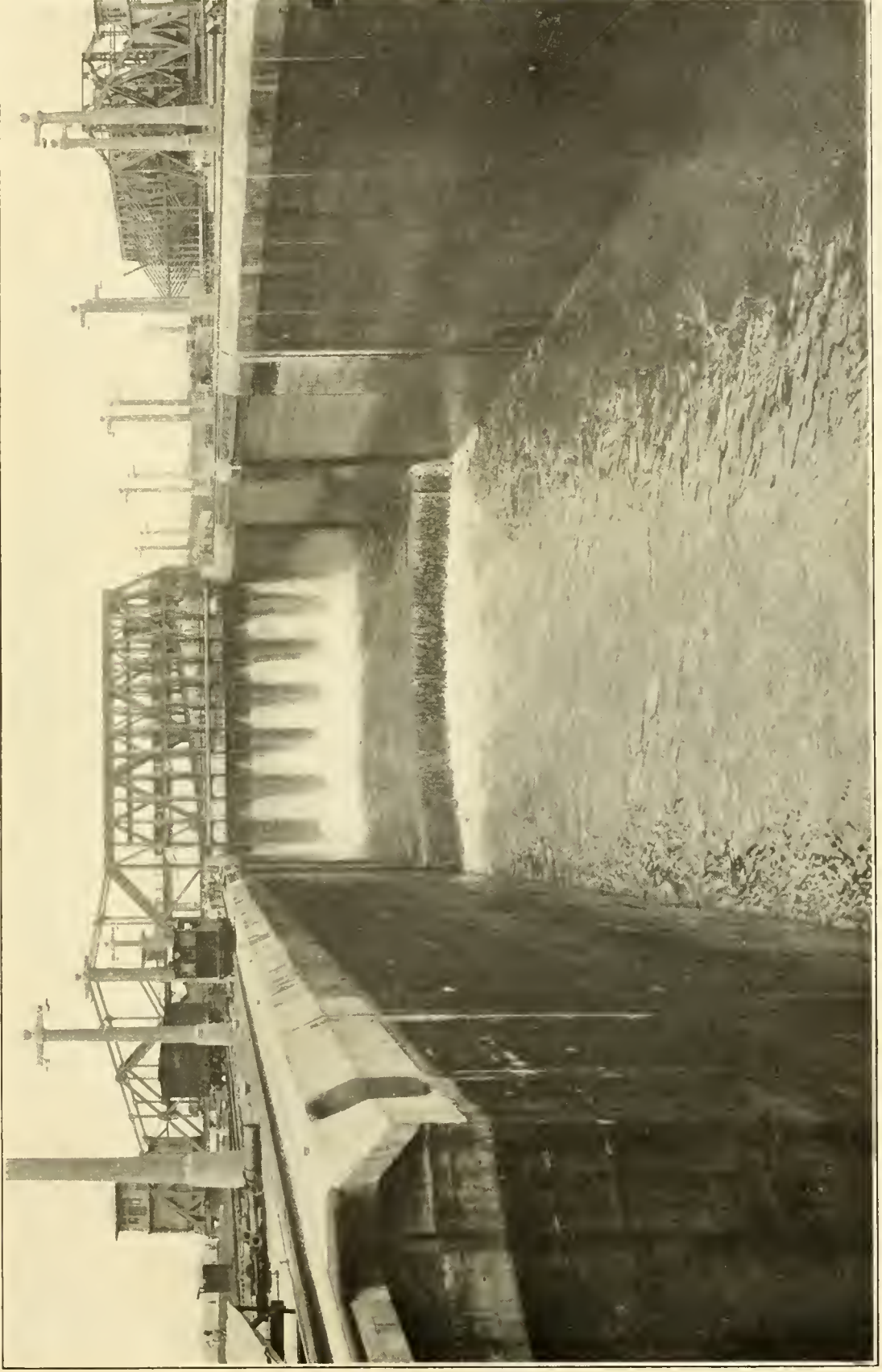
DIVISION OF LIGHTHOUSES.

The construction and placing of lights and beacons was continued during the year in charge of Asst. Engineer W. F. Beyer, assisted by Supervisor Charles Stubner. With the exception of the light on the west breakwater, all the aids to navigation were placed which could be located without interference with construction. The placing of the remainder was held in abeyance until construction should permit. At this stage of the work the division was turned over for operation and maintenance to the Division of Canal Transportation.

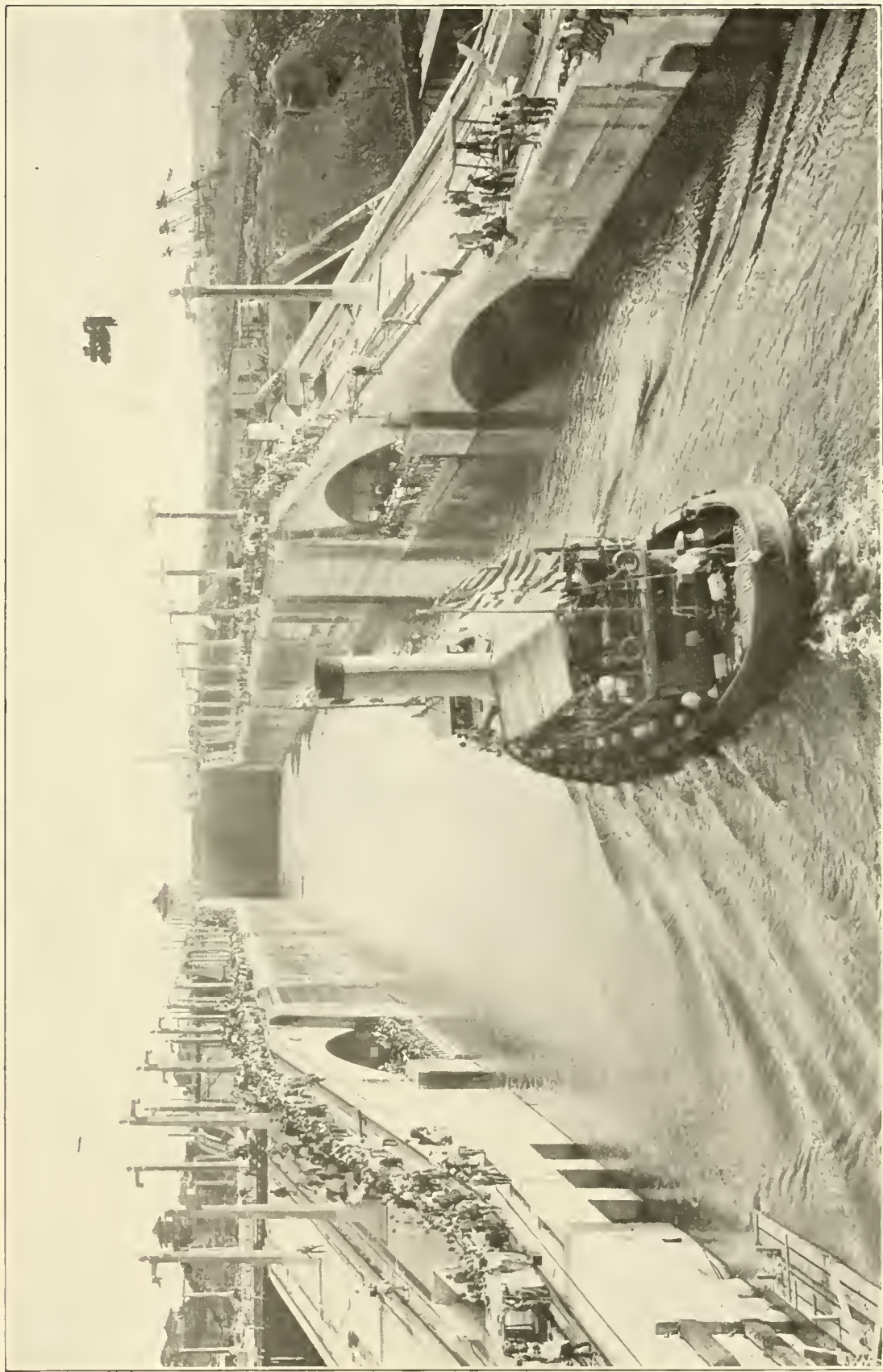
Respectfully,

H. F. HODGES,
Engineer of Maintenance.

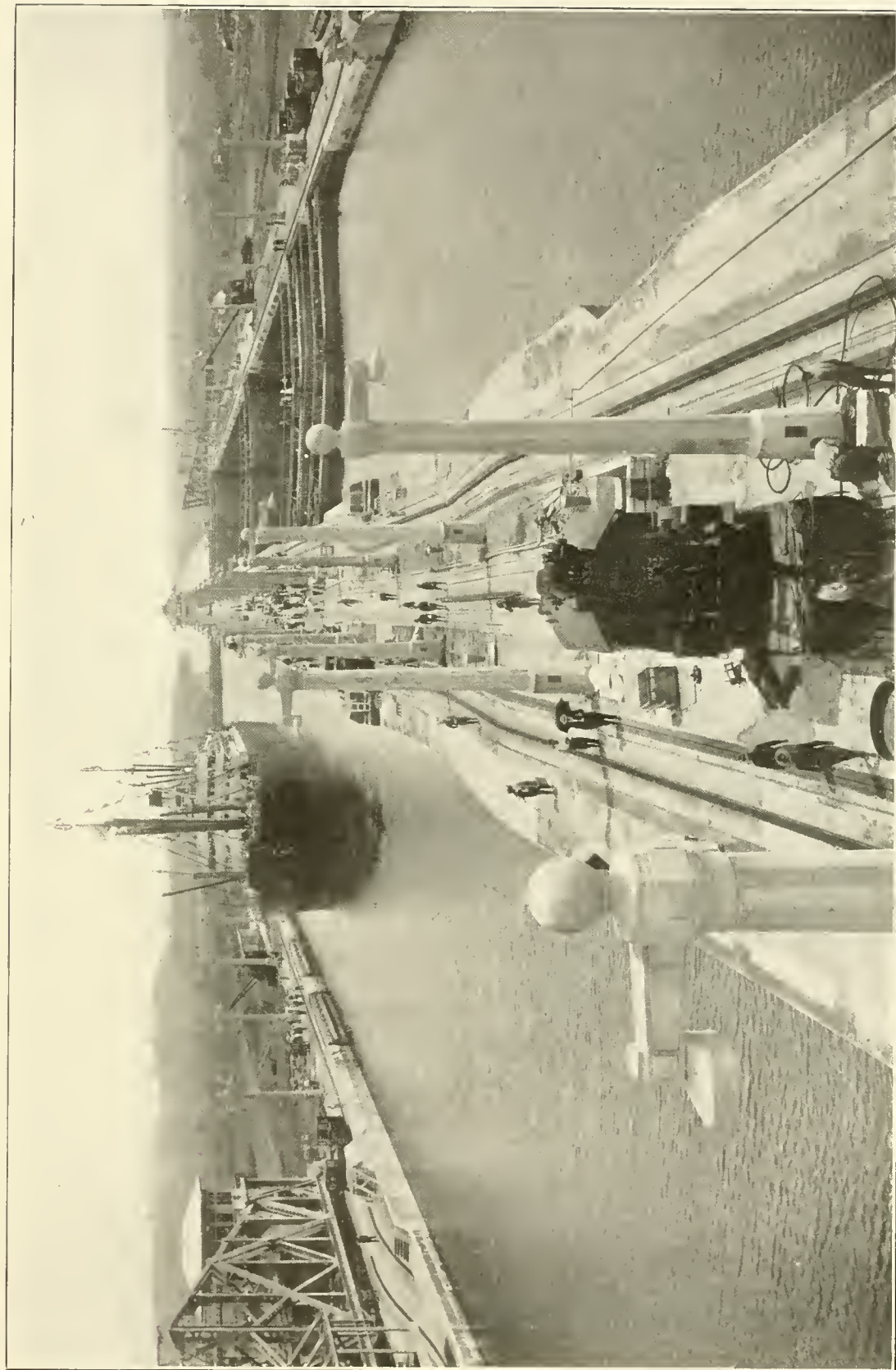
Col. GEORGE W. GOETHALS, United States Army,
Governor, The Panama Canal.



OPERATION OF GATUN LOCKS. EAST EMERGENCY DAM SUBJECTED TO HEAD OF 50 FEET OF WATER. LOOKING SOUTH FROM INTERMEDIATE GATES. MAY 6, 1914.



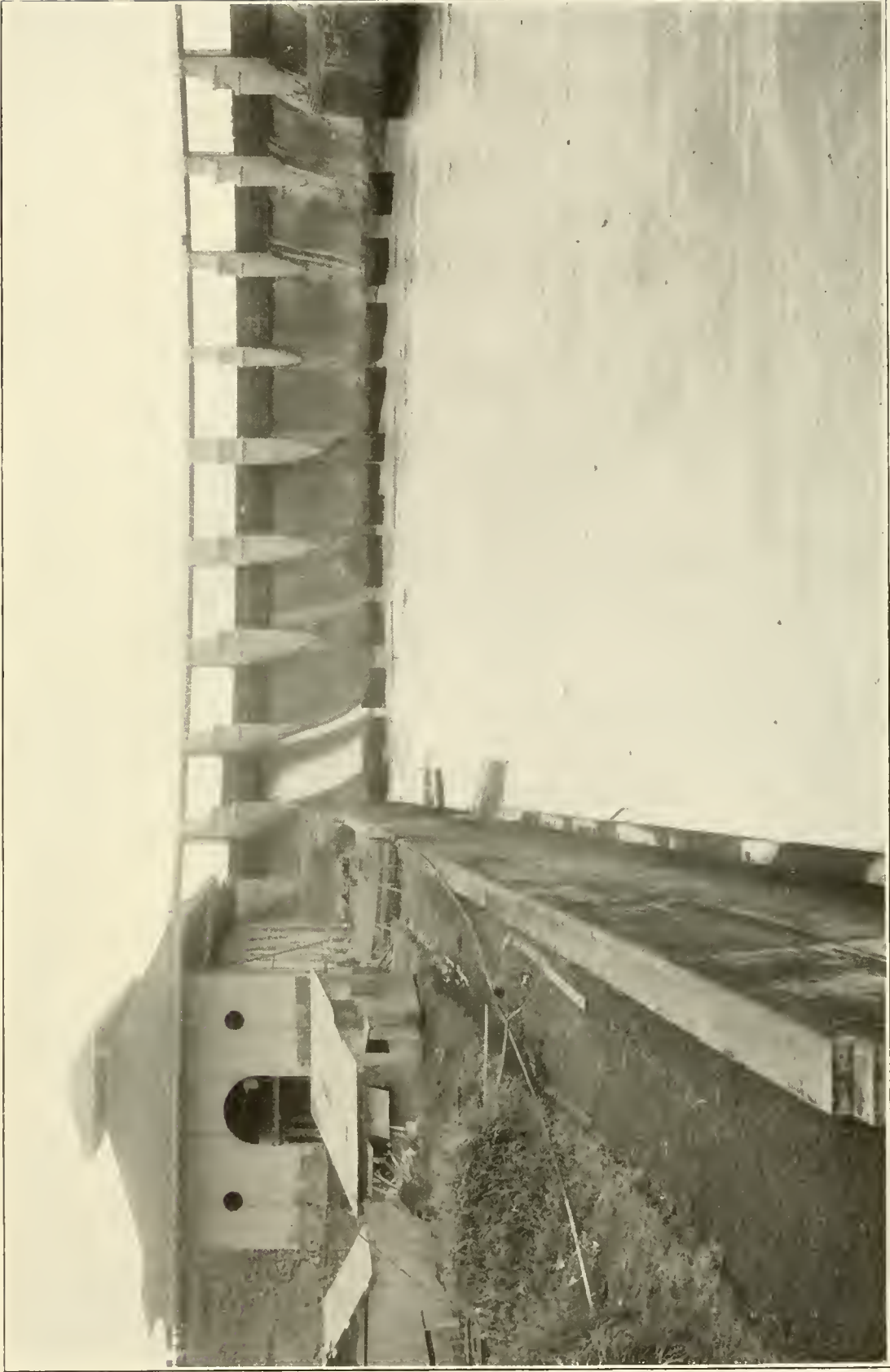
OPERATION OF GATUN LOCKS. FIRST BOAT THROUGH. TUG "GATUN" ENTERING LOWER LOCK, WEST CHAMBER. LOOKING SOUTH FROM FOREBAY. SEPTEMBER 26, 1913.



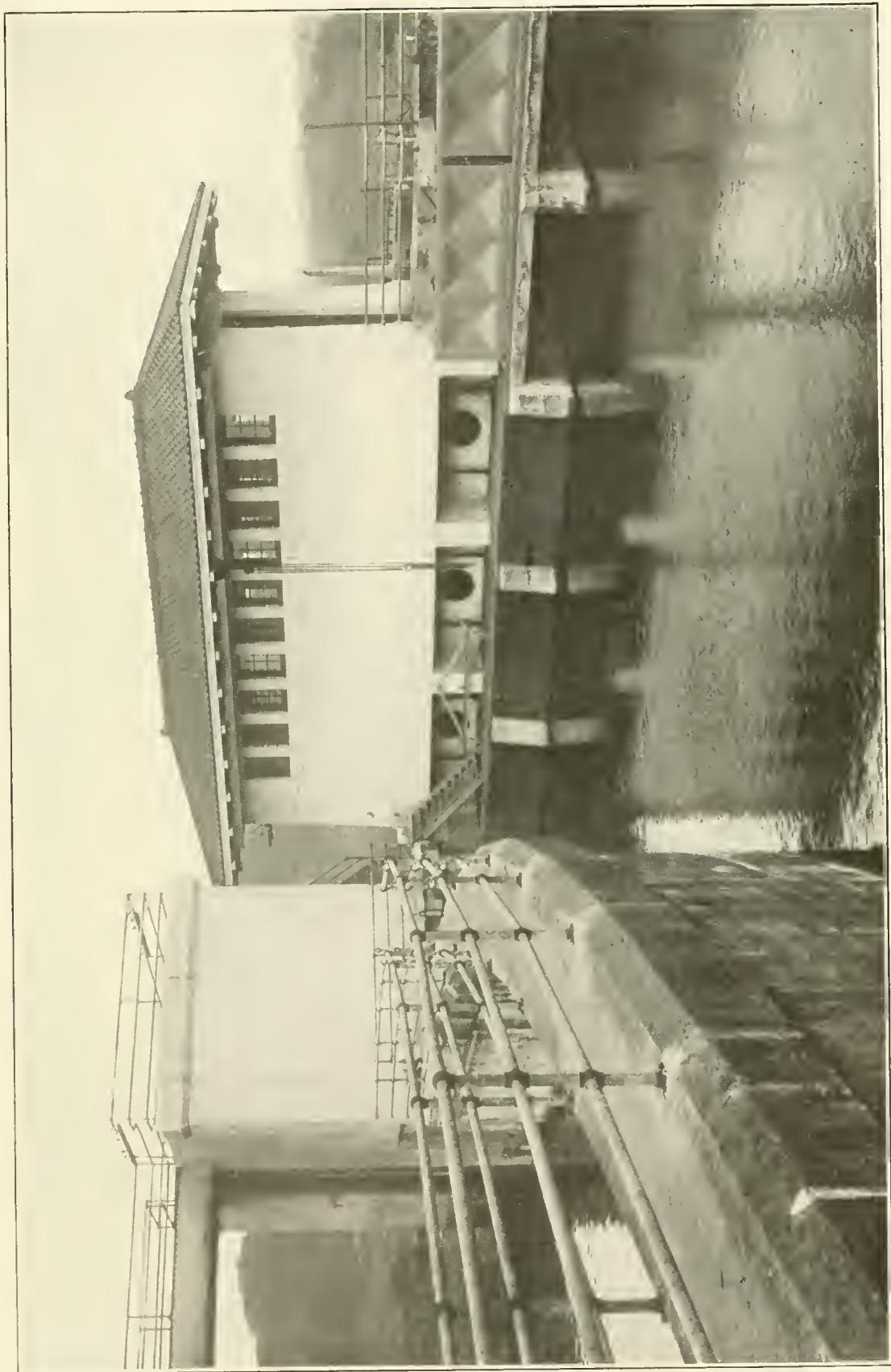
OPERATION OF GATUN LOCKS. S. S. "ANCON" LEAVING UPPER WEST CHAMBER AND ENTERING THE LAKE.



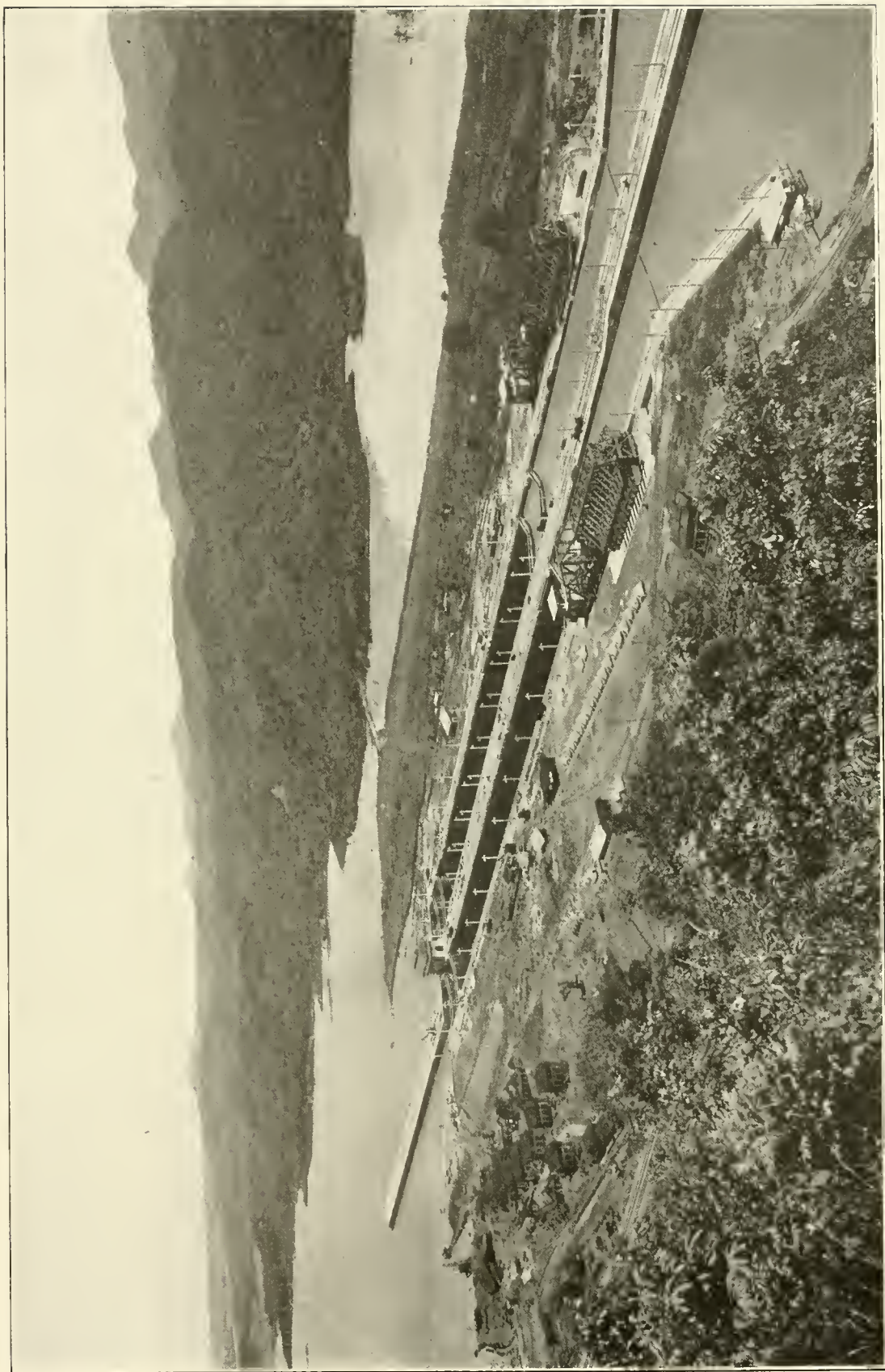
GATUN SPILLWAY DAM. OPENING OF SEVEN GATES. LOOKING WEST FROM EAST ABUTMENT. DECEMBER 30, 1913.



GATUN SPILLWAY DAM COMPLETED, AND HYDROELECTRIC STATION UNDER CONSTRUCTION. LOOKING SOUTH.
FEBRUARY 7, 1914.



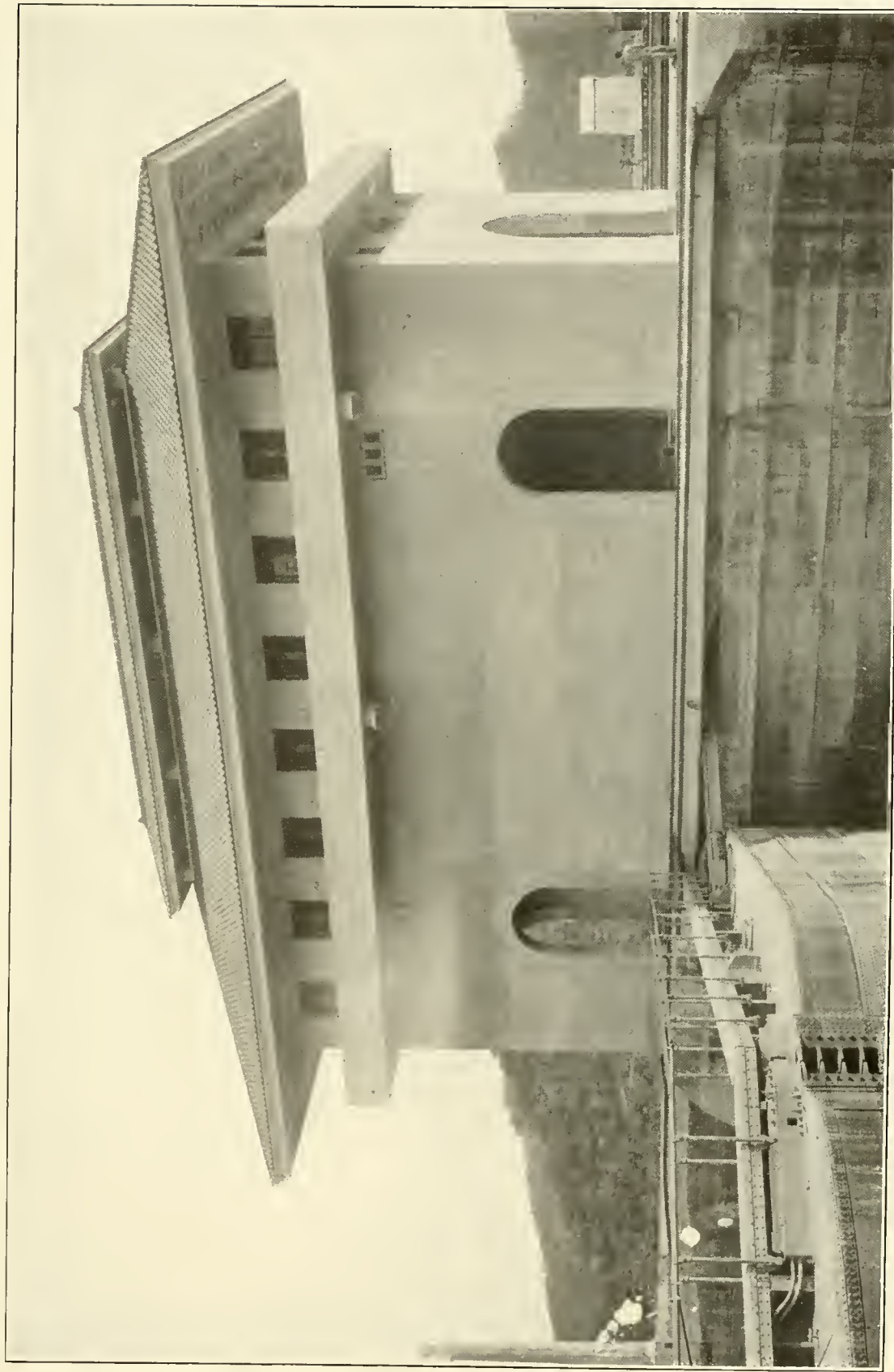
GATUN HYDROELECTRIC STATION. EXTERIOR OF GATE HOUSE.



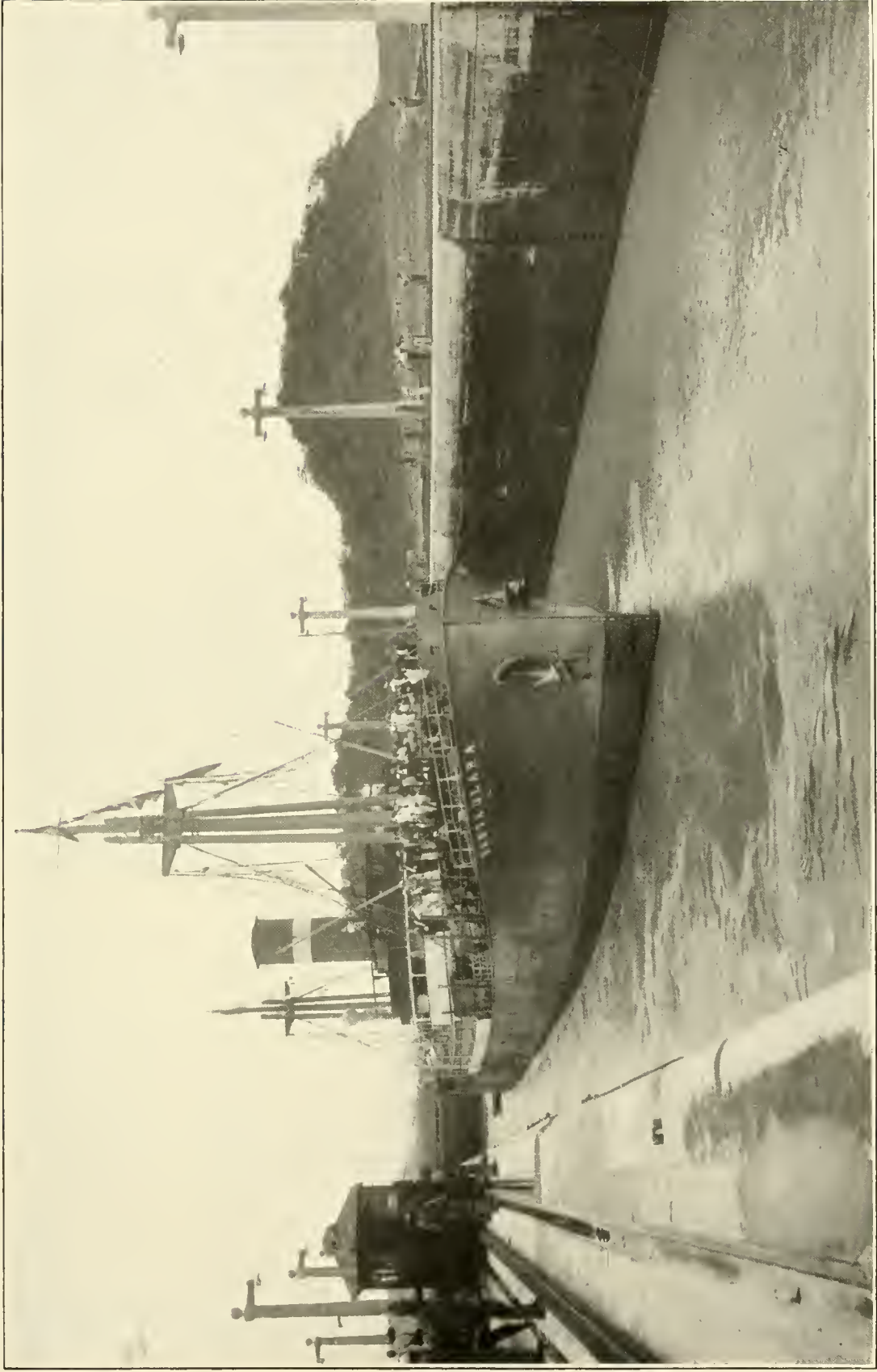
PEDRO MIGUEL LOCK. GENERAL VIEW FROM LUISA HILL. JUNE 6, 1914.



PEDRO MIGUEL LOCK. WEST CHAMBER, ILLUMINATED.



PEDRO MIGUEL LOCK. CONTROL HOUSE.



OPERATION OF MIRAFLORES LOCKS. S. S. "SANTA CLARA" IN UPPER WEST CHAMBER. LOCK FILLING. LOOKING SOUTH.
JUNE 18, 1914.



MIRAFLORES LOCKS. CONTROL BOARD.

APPENDIX A-1.

REPORT OF THE ELECTRICAL AND MECHANICAL ENGINEER.

CULEBRA, *July 18, 1914.*

SIR: I have the honor to make the following report of operations during the fiscal year ending June 30, 1914, on work performed in this subdivision of your office, including the design, inspection, manufacture, and erection of electrical and mechanical equipment for the operation of the locks, spillways, and canal.

As the equipment for the operation of the locks has been quite fully described in previous reports, the greater portion of this report will cover the actual operation of the machines as erected and put into service.

A number of changes have been made in the designing and drafting-force personnel during the past year, due to the approaching completion of the work. Mr. C. C. Coppin, assistant engineer, resigned July 6, 1913, and Mr. C. B. Larzelere, assistant engineer, resigned October 26, 1913, and after this date the work has been in charge of Mr. C. J. Embree, assistant engineer. The inspection of the material purchased under first-division requisitions in the United States has been continued under the direction of Mr. Frank A. Browne, assistant engineer.

The erection force has been under the direction of Mr. Ernest E. Lee, superintendent of erection, and Mr. F. C. Clark, assistant superintendent of erection, until May 28, when Mr. Clark was appointed superintendent of the Pacific locks, Mr. Lee taking over the entire construction work. Mr. C. P. Fortney resigned as mechanical supervisor of Gatun Locks and Mr. T. H. Jordan resigned as mechanical supervisor of the Pacific locks. Mr. T. W. McFarlane and Mr. F. J. Lewis were appointed to fill the respective vacancies. In the erection of the electrical equipment at the locks Mr. W. R. Holloway and Mr. G. A. Balling have continued as electrical supervisors of the Pacific and Atlantic locks, respectively. Mr. W. R. McCann has continued as supervisor of the work in connection with the hydroelectric station, Miraflores, Balboa, Gatun, and Cristobal substations, as well as the transmission line. The testing work for the Gatun Locks was in charge of Mr. S. H. Grauten, testing engineer, until June, when he resigned, and Mr. E. D. Stillwell was appointed testing engineer to fill the vacancy. Mr. R. H. Whitehead, testing engineer, has remained in charge of the tests for the Pacific locks. The local inspection of equipment was accomplished by Mr. E. C. Smith, inspector in charge.

ERECTION WORK—CONCRETE.

Between June 30, 1913, and October 15, 1913, the first division was handling only a portion of the concrete construction work of the locks, principally in connection with the installation of lock-operating machinery. On October 11, 1913, the chairman and chief engineer issued a circular reading as follows:

Effective October 15, 1913, the Gatun Locks, exclusive of back fill, will be transferred from the Atlantic division to the first division, chief engineer's office. On the same date the Pedro Miguel and Miraflores Locks, exclusive of the back fill, will be transferred from the fifth division to the first division, chief engineer's office.

Previous to June 30, 1913, the first division had placed 35,927 cubic yards of concrete, and between June 30 and October 15 had placed 22,354 cubic yards. Since October 15, 1913, the first division has placed a total of 21,004 cubic yards of concrete, or a total of 43,358 cubic yards in the past fiscal year, a grand total of 79,285 cubic yards to date.

During the past year the first division has had an average erection force of 2,350 silver and 371 gold employees, or a total of 2,721 men employed on the locks, hydroelectric station, and transmission-line construction work. The maximum weekly force consisted of 3,830 silver and 508 gold, or a total of 4,338 employees for the week ending January 28, 1914.

GATUN HYDROELECTRIC STATION.

The construction of Gatun hydroelectric station has continued during the past year, the building and equipment being turned over to the permanent operating force on June 18, 1914. As you have been advised in our former reports, the station is equipped with three 2,500-kilowatt volt ampere units, each generating three-phase current at 2,200 volts and driven by 3,600-horsepower Pelton water wheels, running at 250 revolutions per minute. The station is equipped with five exciters—three 50-kilowatt machines direct connected to the turbine units and two 100-kilowatt generators direct connected to 150-horsepower induction motors. The generators are equipped with protective reactance and the necessary switching equipment for main and auxiliary buses, and a total of 24 outgoing feeders, 14 of which are double-throw, operating in either the main or auxiliary bus, and the remaining 10 being single-throw and connected to either the main or auxiliary buses.

At the present time all of the double-throw feeders are in service, four of them being connected direct to Gatun substation, four others going to Gatun substation via manhole 10-B, where provision has been made for tapping in on the Gatun steam station. This makes a total of eight feeders which are connected to Gatun substation, the remaining six being used for supply of current to Gatun locks. All 14 outgoing feeders are 3/C, 4/0, varnished cambric-insulated, lead-sheathed cables.

TRANSMISSION-LINE MATERIAL.

December 19, 1912, the Washington office issued the circular for the material and equipment of the Balboa-Cristobal transmission line. Under date of July 8, 1913, the General Electric Co. was

awarded the contract for the electrical material for the complete equipment for four substations—Cristobal, Gatun, Miraflores, and Balboa. Under date of April 25, 1913, the Locke Insulator Manufacturing Co. was awarded the contract for four thousand 3-unit suspension type insulators and two thousand five hundred 3-unit strain-type insulators for the support of the high-tension lines. On March 31, 1913, the United States Steel Products Co. was given the contract for furnishing 824 transmission-line bridges, as well as the copper-clad ground wire and 2/0 stranded copper conductor for the transmission lines, and on September 11, 1913, they were given the contract for furnishing and erecting the structural steel for four substation buildings.

June 25, 1914, a contract was awarded to the United States Steel Products Co. for five special 84-foot towers, to be delivered, complete, by August 25, 1914.

GATUN SUBSTATION.

Excavation for Gatun substation was started on November 26, 1913, the steelwork being erected by the contractor, and completed February 19, 1914. The erection of electrical equipment in the building has been governed by the progress made in building construction, and at the present time the substation electrical equipment is 37 per cent installed.

The building is of steel, poured concrete, and concrete block construction, 75 feet 4 inches by 129 feet 4 inches outside dimensions, the equipment being installed in the basement, first, mezzanine, and second floors. In the basement, adjacent and parallel to the long dimension of the building, an air tunnel 8 feet deep and 6 feet broad is installed for admitting air to the transformer chambers. The air enters through a grating at each end of the building, and outlets are provided into each power transformer compartment located on the floor above. Additional compartments have been provided in the basement, arrangements being made for the installation of two storage tanks for transformer oil, and space left for the storage of any material required for the operation of the plant.

The main switchboard is located on the first floor in a room 17 feet 6 inches by 89 feet. The switchboard is made up of 20 panels, upon which have been mounted the switches and instruments for the remote control of all substation apparatus. At each end of the switchboard room are the stair wells to the mezzanine and second floors, while immediately back of the switchboard a room is provided for a small shop, an oil filter and compressor room, the storeroom, an office, and colored men's toilet room. The other side of the building, next to the outside wall, is space allotted to the transfer of the power transformers which occupy adjacent compartments, space being provided for two transformers at each end of the building and two lightning arresters of the aluminum cell type, each of which occupies a compartment near the center of the building. The power transformer equipment of this station consists of three 2,667 kilowatt volt amperes, 3-phase transformers, the building being provided for the installation of a fourth unit at some future date. Each transformer is of the self-cooled type, built for operation on a 2,200-volt

3-phase delta system, and stepping the pressure up to 44,000 volts, 3-phase, star connected, grounded neutral system. Each transformer is mounted on a truck and installed in a compartment 17 feet by 19 feet 4 inches, the floor space occupied by the transformer being 12 feet 7 inches by 12 feet 7 inches. The front of the transformer compartments is provided with steel roller doors, in this way making the compartments fireproof. The transformers are ventilated by obtaining air from the basement tunnel through a grating in the floor, the air passing over the cooling coils of the transformer and up to the ventilating duct, where the air is carried to the exterior of the building.

The lightning arresters are of the aluminum cell type usually used on an ungrounded star system of 45,000 volts and are installed in compartments of the same size as those occupied by the transformers. In order to allow for the discharge of the horn gaps, an opening has been provided just above each arrester in the second floor.

In a room just back of the main switchboard a small air compressor has been installed which will be used for cleaning the high-tension equipment, instruments, insulators, and all parts of the installation which might be harmed by an accumulation of dust. The room used for the air compressor also contains an oil pump, filter, and drying oven. This equipment is required in order that the oil in the transformers may be kept as free of moisture as possible.

The battery equipment consists of 64 Manchester cells, the battery having a capacity of 160 ampere hours on an 8-hour discharge. The cells are to be mounted in a compartment similar to that used at the hydroelectric station.

The second floor of the substation is divided equally between the high and low tension switching equipment. That portion of the second floor which is immediately above the switchboard is taken up by the 2,200-volt bus compartments as well as the switch and instrument compartments of the outgoing feeders. The substation has a capacity of 20 outgoing 3-phase feeders of a capacity of 300 amperes per phase. Arrangements have been made to install all the compartments at the present time, although the electrical equipment for only 14 feeders is being installed, allowing for a future extension of six 3-phase feeders.

The high-tension switching equipment is installed upon the second floor just above the transformer compartments. The present arrangement provides for two outgoing 44,000-volt 3-phase lines, each being star connected with a grounded neutral. The outgoing 44,000-volt lines are carried out through the roof by means of roof bushings to the transmission-line taps.

The incoming 2,200-volt cables are run from the oil switches on the second floor into a cable and conduit passage located just under the second floor and above the main switchboard room. From this cable and conduit passage the cables go down four shafts, two at either end of the building, and into the large manholes which have been provided. The manholes have been so arranged that cables can be carried in or out of the building from any direction.

The electrical equipment for the substation has cost The Panama Canal \$10.94 per kilowatt volt ampere of capacity, the total cost of the equipment being approximately \$90,965.62. The total cost of the steelwork used in the erection of the building was \$31,997.60, or \$3 per kilowatt volt ampere of ultimate substation capacity.

CRISTOBAL SUBSTATION.

Cristobal substation has been installed with the object of caring for the power requirements of the coal-handling plant, the Mount Hope pumping plant, and miscellaneous power requirements in the vicinity of Cristobal. The excavation for Cristobal substation was started in March 4, 1914, the erection of steel following the construction of the concrete footings, the steelwork being completely erected by May 6, 1914. This building differs from that of Gatun substation in the fact that the first floor is made entirely of reinforced concrete beam and slab construction, made necessary by the fact that the station is built on "made land." It was also necessary to install a sump pump in the basement because of the low elevation of the tunnel floor (elevation, 0.0 feet). The substation's ultimate capacity is the same as that of Gatun, the present electrical installation consisting of two 2,667-kilowatt volt ampere transformers and eight 2,200-volt 3-phase outgoing feeders. The concrete bus, switch, and instrument compartments for 16 outgoing feeders are installed, which should allow sufficient reserve for future growth.

The installation of the electrical equipment in Cristobal substation is approximately 7 per cent complete, the limiting feature being the building construction work. The electrical equipment in this substation will cost The Panama Canal approximately \$12.83 per kilowatt volt ampere of present capacity, the total cost of the equipment being \$68,365.39.

MIRAFLORES SUBSTATION.

Miraflores substation has been installed with the object of caring for the power requirements of Miraflores and Pedro Miguel Locks, and also for the purpose of serving as a step-up transformer station for Miraflores steam plant. This station is practically a duplicate of Gatun substation, except that the switchboard is arranged for a total capacity of 16 outgoing feeders, equipment being installed at the present time for 12 feeders. The general construction of the building is also slightly different from the other stations, as arrangements have been made for the accommodation of four sets of generator leads from the Miraflores steam station. Concrete compartments for 20 feeders have been constructed, although the electrical equipment for only 12 feeders will be installed at the present time. Concrete instrument and oil switch compartments are being constructed for four 2,667-kilowatt volt ampere power transformers, three transformers being erected at the present time.

The foundation excavation work was commenced October 29, 1913, and completed December 31, 1913, the steelwork being completely erected by March 9, 1914. The building construction has been continued, the electrical equipment being installed whenever the building construction work would permit. The erection of the electrical equipment is 22 per cent complete and is progressing satisfactorily. The electrical equipment for Miraflores substation (exclusive of that required for Miraflores steam station connections) cost \$88,629.49, or a cost of \$11.08 per kilowatt volt amperes of capacity.

BALBOA SUBSTATION.

Balboa substation was located primarily for the purpose of supplying power to Balboa shops, the air-compressor plant, dry-dock pumping plant, coal-handling plant, and Ancon pumping plant, as well as other local power requirements.

All concrete compartments for the maximum output of the station are to be erected, although feeder equipment is being installed for only 14 three-phase 2,200-volt circuits. The switchboard is equipped with instruments for three 2,667-kilowatt volt ampere power transformers and 14 feeders, blank panels being provided for the future installation of instruments and control equipment for one 2,667-kilowatt volt ampere power transformer and two additional feeders.

The foundation work of the Balboa substation was commenced April 27 and completed the last of May. The steel-construction work was started immediately thereafter and completed by June 27, 1914. The building work has been continued by the supply department, the electrical work being limited by their progress. Four per cent of the electrical equipment has been installed up to the present date, our work being confined to the installation of a very small amount of conduit required in the first floor, and the erection of the air compressor.

The total cost of the electrical equipment for Balboa substation is approximately \$91,578.49, or a cost of \$11.44 per kilowatt volt ampere of capacity.

DARIEN SUBSTATION.

In order to supply power to the power house of Darien wireless station, arrangements have been made to install a small substation of 400-kilowatt capacity, tapping the transmission line and stepping the voltage down to 440 volts, three-phase, delta connected. Specifications for this equipment have been forwarded to the general purchasing officer.

SUBSTATION AT GAMBOA.

The change in location of the pumping plant from Miraflores to Gamboa has made it necessary to install a substation at the latter location by tapping the transmission line. An addition has been made to the pumping plant providing for the installation of two 500-kilowatt power transformers and the necessary electrical equipment for stepping the 44,000-volt transmission-line pressure down to a 2,200-volt, three-phase, delta connection to the buses of the pumping plant. A tap will be taken from the pumping plant and carried to the Gamboa gravel pit, which is located near this point, the gravel-handling equipment requiring approximately 100 kilowatts. The specifications for the necessary equipment for the Gamboa substation have been issued and forwarded to the general purchasing officer.

TRANSMISSION-LINE SYSTEM.

Track-span bridges.—Under date of March 31, 1913, the award was made for transmission-line bridges to the United States Steel Products Co. The original order called for 627 single and 150

double track span bridges, the order being changed under date of May 16, 1913, providing for the manufacture of 777 double-track span bridges, no single-track span bridges being purchased at that time. Under date of August 23, 1913, advantage was taken of the increase clause of the original contract, and an additional order was purchased, consisting of 27 double and 20 single track span bridges.

The installation of the bridges commenced with the foundation excavation of bridge 17 of mile 34 on June 15, 1913. The first steel tower erected was at bridge 12 of mile 39, the erection work being completed September 22, 1913.

At the end of this fiscal year a total of 814 towers have been erected, 794 of them being double and 20 single track span bridges. The only towers remaining to be erected are the five special towers, which will be required at Cristobal and Balboa terminals, and one bridge at Cristobal. In the construction of the bridge foundations a total of 7,580 yards of concrete, 280 tons of reinforcing bars, and 360 tons of old steel rails have been placed.

Transmission lines.—The installation of track span bridges at this time has been carried out with the primary object of supporting the two 44,000-volt, three-phase transmission lines which will span the Isthmus. The secondary object of the bridges was to provide for the future electrification of the Panama Railroad should traffic conditions warrant the change in mode of operation.

For the transmission lines bids were obtained, and, under date of March 31, 1913, an award was made to the United States Steel Products Co. for furnishing 1,500,000 feet of No. 2/0 B. & S. gauge stranded copper conductor to be used for the two transmission lines and 500,000 feet of $\frac{5}{16}$ -inch copper-clad wire for the ground wires of the lines, the total contract price being \$132,055.03.

The orders for cable and wire have been increased from time to time, the total amount received to date being 1,562,208 feet of 2/0 B. & S. gauge stranded copper and 512,065 feet of $\frac{5}{16}$ -inch copper-clad wire.

Under date of January 3, 1914, the installation of the line was started at mile 39, bridge 15, the construction work advancing toward Colon. At the end of this fiscal year a total of 44.46 miles of transmission line (which is the equivalent of 1,408,443 feet of 2/0 conductor cable) has been erected. The line remaining to be installed consists of the short links connecting each end of the lines with Cristobal and Balboa substations, respectively.

As this division loaned the electrical division 71,898 feet of the 2/0 copper conductor for the Gold Hill 11,000-volt transmission line and 45,450 feet of 2/0 cable has been used for making connections between the $\frac{5}{16}$ -inch ground wire and the ground plates, there remains approximately 36,417 feet of 2/0 B. & S. copper cable on hand for completing the terminal connections at Balboa and Cristobal substations.

Transmission-line strain and suspension insulators.—In order to support the transmission-line conductors it was decided to use the strain and suspension type of insulators. Specifications were issued, and under date of April 25, 1913, a contract was made with the Locke Insulator Manufacturing Co. providing for the purchase of 4,000 three-unit suspension-type insulators and 2,500 three-unit strain-type insulators, at a total contract price of \$114,520.

The insulators are equipped with monel-metal fittings, the porcelain parts having a brown glaze finish, the general construction of the units being the same as that used in general high-tension line construction in the United States. Up to the end of the fiscal year a total of 2,080 strain and 3,813 suspension insulators have been installed. This will leave 420 strain and 187 suspension insulators for finishing the transmission line and completing the installation at Darien and Gamboa.

LOCK MACHINERY.

Rising-stem gate-valve machines, mechanical equipment.—As you were advised in the annual report for the fiscal year ending June 30, 1913, the contract for 114 rising-stem gate-valve machines was made with the Wheeling Mold & Foundry Co., the machines being delivered complete by January 27, 1913. The erection of the machines has proceeded, the mechanical installations being completed on the following dates:

Gatun, 56 rising-stem gate-valve machines, November 22, 1913.

Pedro Miguel, 24 rising-stem gate-valve machines, May 22, 1913.

Miraflores, 36 rising-stem gate-valve machines, December 30, 1913.

Rising-stem gate-valve machines, electrical equipment.—The electrical equipment for the rising-stem gate-valve machines was purchased of the General Electric Co., the delivery being completed January 15, 1913, the installation of the apparatus being completed on the following dates:

Gatun, 56 rising-stem gate-valve machines, February 12, 1914.

Pedro Miguel, 24 rising-stem gate-valve machines, March 30, 1914.

Miraflores, 36 rising-stem gate-valve machines, March 30, 1914.

Operation.—During the last fiscal year the machines have been operated under various load conditions, both by means of local control switches and remote control from the switchboards in the control houses.

With the report of last year I submitted an analysis of the operation of the rising stem gate valves, and also submitted an outline predicting the operating conditions which would exist with the valve breaking the seals against a head of 79 feet of water, which is the worst condition under which they will operate. Reference to the data submitted at that time will indicate that it was expected that the machines would require 634 pounds torque at 1-foot radius under these conditions of operation. Tests were made at Miraflores Locks with one of the valves operating under variable heads. I am attaching hereto plate No. 76, showing the torque characteristics of a machine operating under variable heads from 0 foot to 52 feet, and by interpolation you will note that the torque required for operating the machine under a 79-foot head will be approximately 684 pounds, or within 7.3 per cent of the value predicted in last year's report. However, it should be borne in mind that tests on a larger number of valves may change the data slightly.

Operation of rising-stem gate-valve machines under full head.—In order to determine whether or not rising-stem valve machines would vibrate excessively under full head, and also to note the operation of roller trains under these conditions, arrangements were made

on November 13, 1913, to make a test on rising-stem valve machines Nos. 248 and 249 at Gatun Locks. The first test was made with water in the upper lock at elevation 77.2 feet, and the level in the middle lock at 13.9 feet, which gave a difference in head on the two sides of the valve of 63.3 feet. Rising stem valve No. 248 was opened under this head, the time of operation being 60 seconds. Moderate vibration was noticed in the east roller train rod, and the chain was apparently under some strain. The west roller train rod gave evidence of vibration, and the chain was apparently not under great tension. All chains and sheaves operated properly. A moment later the same valve was closed with a difference in head between the two locks of 59.6 feet, the valves operating satisfactorily, the vibration of the parts being approximately the same as upon the previous stroke.

The next operation consisted of opening rising-stem valve No. 249, the difference in levels being 53.3 feet. A vibration was noted in the west roller train, the chain being under some tension. The east roller train gave no evidence of being under any considerable strain. During these operations it was noted that the vibration and strain upon the roller train in each case occurred upon the side farthest away from the center line of the culvert. During these operations a graphic ammeter was attached to the incoming power lines to the machines and observations were obtained for the opening and closing strokes of the valves. The result indicated by the graphic ammeter shows that the load is practically constant for the full operation of the valve, the duty cycle not being of the type expected at the time that the machine was designed. (The original design appeared to indicate that the torque at the beginning of the opening stroke would be very much greater than that required near the completion of the operating cycle.) The curves for the closing stroke under full head and under no head are identical, being a uniform flat line, the value in each case being the same. The following results were obtained for the operation of the valves under the various heads:

	Head, in feet.	Average amperes.	Horse-power.	Motor torque pounds (feet).	Pull on cross-head.
Opening rising-stem valve No. 248	63.3	148	54	603	33,400
	0	126	38	424	23,600
Closing rising-stem valve No. 248	59.6	84	13	139	7,720
	0	84	13	139	7,720
Opening rising-stem valve No. 249	53.3	144	49	547	30,400
	0	125	38	423	23,500
Closing rising-stem valve No. 249	49.6	90	10	107	5,930
	0	90	10	107	5,930

Under the above tests the voltage on the machines was 238 and the machine efficiency was $33\frac{1}{3}$ per cent.

Cylindrical valve machines.—As you have been advised in the previous reports, the Wheeling Mold & Foundry Co. furnished the cylindrical valve machines, the contract date for delivery of the last machine being January 1, 1913, the actual delivery being January 6, 1913. The actual completion of all mechanical details in con-

nection with the cylindrical valves was accomplished upon the following dates during the past fiscal year:

Mechanical: Gatun, 60 cylindrical valve machines, June 30, 1913; Pedro Miguel, 20 cylindrical valve machines, December 16, 1912; Miraflores, 40 cylindrical valve machines, May 1, 1913.

The electrical equipment of the cylindrical valves was purchased of the General Electric Co., the contract date for the completion of the delivery of the machines being January 31, 1913, the actual delivery being February 16, 1913. The control panels for the machines were all purchased of the same company, the contract date for complete delivery being January 1, 1913, the actual delivery being completed November 15, 1912. The limit switches were purchased of the Cutler Hammer Manufacturing Co. So far as the electrical details are concerned the final dates of completion of the cylindrical valve machine installations at all locks were as follows:

Electrical: Gatun, March 30, 1914; Pedro Miguel, January 27, 1914; Miraflores, February 27, 1914.

Auxiliary culvert valve machines.—The electrical and mechanical details for the auxiliary culvert machines were ordered from the same manufacturers that furnished the cylindrical valve machines. There are a total of 12 auxiliary culvert machines for all locks, the mechanical and electrical work being completed on the following dates:

	Mechanical work.	Electrical work.
Gatun, 4 machines.....	Dec. 9, 1912	Mar. 10, 1914
Pedro Miguel, 4 machines.....	Mar. 26, 1913	Mar. 5, 1914
Miraflores, 4 machines.....	Apr. 18, 1913	Mar. 31, 1914

Guard-valve machines.—Eighteen guard-valve machines were purchased of the Earle Gear & Machine Co., of Philadelphia, Pa. They were to be delivered March 31, 1913, the actual complete delivery being July 9, 1913. The motors and contractor panels were purchased of the General Electric Co., and according to the contract the motors were to be delivered November 1, 1912, the date of complete delivery being February 26, 1913. The contractor panels were to have been delivered October 1, 1912, their actual complete delivery being February 16, 1913. The guard-valve machines have all been installed complete at the present writing, with the exception of a portion of the electrical work at Miraflores Locks. The progress of erection at all locks is as follows:

	Mechanical work.	Electrical work.
Gatun, 6 machines.....	Aug. 11, 1913	Apr. 25, 1914
Pedro Miguel, 6 machines.....	Sept. 25, 1913	June 29, 1914
Miraflores, 6 machines.....	June 13, 1914	62 per cent complete.

Tests on guard valves.—Since the completion of the machines a number of tests have been made to determine whether or not they

would operate satisfactorily as originally designed. It was found necessary to make a number of changes, the most important ones being as follows:

Owing to the fact that the roller trains were connected into the operating mechanisms by means of chains run over pocketed sheaves, their operation was found to vary slightly from the theoretical conditions of the design. Arrangements were made to remove the pocketed sheaves from the main-line shafting and connect the chains in on the counterweights in such a manner that their movement would be positively controlled by the raising or lowering of the counterweights during the operation of the machines. As the weight of the roller train was approximately 5,000 pounds, this placed a slight eccentric load upon the counterweight and it was found necessary to provide guide shoes for the weights in the counterweight pits.

The guard valves are driven by means of a motor which is electrically a duplicate of the miter gate moving machine motor, with a worm and worm wheel, pinion, and spur-gear drive to the pocketed sheaves on the main shaft. The pinion shaft driving the main spur gear was not provided with an outboard bearing, which it was found necessary to add. The installation of this outboard bearing overcame the tendency of the pinion to get out of line with the main spur gear.

Tests upon guard valve machines 306, 307, and 308 at Pedro Miguel Locks on April 17, 1914, indicated that the leakage of all three valves is approximately 7 cubic feet per second when the valves are operating under a 30-foot head.

While operating the guard-valve machines under variable heads the following power consumptions were noted upon machines No. 306, No. 307, and No. 308 at Pedro Miguel:

	Opening valve.	Closing valve.
	<i>Amperes.</i>	<i>Amperes.</i>
No. 306, run No. 1, 30-foot head.....	60	35
No. 307, run No. 1, 28-foot head.....	41	27
No. 308 run No. 1, 24-foot head.....	50	40
No. 308, run No. 2, 30-foot head.....	50	25

During the above tests the pressure upon the motors was 120 volts, the maximum current demand being 60 amperes. The horsepower output of the motor was 14.2, and as the motor operated at 450 revolutions per minute the actual torque upon the motor-driving shaft was approximately 165 pounds at 1-foot radius. With the motor operating under 220 volts, the starting torque is approximately 1,200 pounds, and as the torque is proportional to the square of the voltage the motor was actually operating with a starting torque of 300 pounds at 1-foot radius with the pressure at 120 volts.

As usual, the testing force made an analysis of the machine, obtaining a detail check upon all dimensions of the equipment as installed. Any variations from the dimensions theoretically desired were corrected before the machines were turned over to the operating force.

Miter gate-moving machines.—All of the parts for the mechanical and electrical installation of the miter gate-moving machines were delivered complete during the last fiscal year. During the fiscal

year ending June 30, 1914, the erection of the machines has been completed, the dates of completion being as follows:

	Mechanical work.	Electrical work.
Gatun, 40 machines.....	Dec. 22, 1913	Feb. 28, 1914
Pedro Miguel, 24 machines.....	Dec. 9, 1913	Mar. 28, 1914
Miraflores, 28 machines.....	Jan. 10, 1914	May 28, 1914

Miter gate-moving machine tests.—After the completion of the miter gate-moving machines a large number of tests were made to determine the conditions under which the most satisfactory operation might be obtained. Perhaps the most interesting of these tests were those which were carried out at Gatun in January, 1914. The purpose of these tests, to be described hereinafter, was to determine what reduction of power and of force would result from the non-simultaneous operation of two gates. The gates selected for the test were the intermediate gates Nos. 31 and 32 of the upper lock at Gatun. The water upstream from these gates is confined by operating gates Nos. 35 and 36 and on the downstream side by gates Nos. 23 and 24. This makes a chamber of 358 feet above and 731 feet below the gates which were being operated. During the test rising stem valves 255 and 254 were left open throughout. One test was made to determine the effect of the gate operation with the valves closed, but it was found that the effect was inappreciable owing to the low heads involved. The tests were first made with gate No. 32 lagging by intervals of 0 to 120 seconds, and again with gate No. 32 leading by the same intervals. Readings were taken on gate No. 32 of the strut pressure and of the voltage at the motor, the motor current being recorded by means of a graphic ammeter. The first cycle was made by the gates starting simultaneously and was followed by allowing gate No. 32 to lag by intervals of 10, 20, 30, 40, 60, and 120 seconds. The results of the current duty cycle of these operations are shown upon plate No. 77 for the opening stroke and plate No. 78 for the closing stroke. A similar series of tests were then made with gate No. 32 leading by similar intervals. The results of the opening strokes for this series is shown on plate No. 79, and the results for the closing strokes are shown on plate No. 80. The maximum current values of the duty cycles for opening and closing the gates with various leads and lags are shown upon plates Nos. 81 and 82. It is seen from these curves that the maximum value of the current is reduced as the time intervals between the starting of the gates is increased in either lagging or leading direction. Several tests were made under these conditions, but it was found that the results varied considerably, due to surges of the water in the locks. It is believed, however, that the curves indicate the maximum values which will occur under the conditions specified. For the closing strokes it appears that the gate lagging from 5 to 10 seconds requires a greater maximum current than would result with simultaneous operation. It is probable, however, that a greater number of tests would have to be made in order to eliminate completely the possible effect of surges in the lock chamber. The maximum values of the pressure of the strut spring for various lags and leads of the gate operation are shown upon plate No. 83 for the opening stroke and upon plate

No. 84 for the closing stroke. It is seen that the force in the strut, as indicated by the pressure of the strut springs, decreases rapidly as the interval of the lag and lead is increased. The curves of maximum current values of the strut show that the greatest reduction of power occurs for intervals within the first 30 seconds, and a very considerable reduction is obtained in the first 20 seconds. The following table will indicate the maximum values for these two cases, the values for zero interval and 120-second interval being added for comparative purposes.

	Seconds.	Maximum Motor amperes.	Torque pounds.	Maximum strut compression.	
				Inches.	Pounds.
Opening stroke with lagging gate.....	0	160	700	2.25	185,000
	20	102	400	1.50	133,000
	30	92	340	.85	87,000
	120	92	340	.10	34,000
Opening stroke with leading gate.....	0	160	700	2.25	185,000
	20	117	480	1.50	133,000
	30	108	440	1.03	99,000
	120	92	340	.72	78,000
Closing stroke with lagging gate.....	0	170	760	2.25	185,000
	20	120	490	1.20	111,000
	30	112	460	1.00	97,000
	120	93	340	.65	73,000
Closing stroke with leading gate.....	0	170	760	2.25	185,000
	20	85	300	.75	80,000
	30	84	300	.45	59,000
	120	84	300	.....	.....

The results of all tests show in a striking manner the advisability of reducing the duty of the motor and the forces of the machine by starting one gate ahead of the other by an interval which, under the conditions observed, would be approximately 20 seconds. The benefit derived from the delayed operation of one gate results from the fact that when one gate only is operating during the critical period when the gates are near the mitered position, the entire area of the chamber is available for the storage of water displaced. The difference of head against which the gate operates is, therefore, approximately one-half of that which would exist in the simultaneous operation of the gates. The phenomena is most striking for the high intermediate gates. It is believed that the condition could be bettered by altering the shape of the upstream side of the sill.

Miter gate-forcing machines.—The miter gate-forcing machines were purchased of the Wheeling Mold & Foundry Co.; the motors, limit switches, and contactor panels were purchased of the General Electric Co., all material being delivered in the fiscal year ending June 30, 1913.

The erection of the machines has progressed with the completion of the gates. A total of 46 machines were purchased, the mechanical and electrical erection being completed as follows:

Lock.	Number of machines.	Mechanical erection completed—	Electrical erection completed—
Gatun.....	20	Jan. 15, 1914	Feb. 14, 1914
Pedro Miguel.....	12	Jan. 12, 1914	Mar. 27, 1914
Miraflores.....	14	Feb. 11, 1914	Mar. 28, 1914
Total.....	46		

¹ Miter forcing machines.

Tests on miter gate-forcing machines.—The jaws of the miter forcing machines are set so that a clearance of one-fourth inch is obtained between the pin and jaw of the machine. Complete tests were made in the States as to the satisfactory operation of the machines under maximum-load conditions and a routine test of the machine indicates that while running light, the load requirements are approximately as follows:

Operation.	Amperes.	Horsepower output of motor.	Pounds torque at 1-foot radius.
Opening jaw.....	15.12	3.7	32
Closing jaw.....	15.29	4.3	38

The values of horsepower and torque as referred to above were obtained from motor characteristics of the machine. For all practical purposes the power required for opening and closing the jaws is the same when the machine is running light.

Towing-track material.—All of the towing-track material purchased under the original orders was delivered previous to June 30, 1913.

Rack track.—During the year tests have brought out the fact that it will be necessary to provide additional rack sections at the top and bottom of all inclines at all locks. For this purpose we have arranged to have the Balboa shops make up 606 feet of additional rack section.

The progress of erection made up to and including June 30, 1914, is as follows:

[Rack track in 1-foot units.]

	Dis-tributed.	Laid.	Frozen.	Com-pleted.
Gatun Locks, 22,182 feet of rack section, (99.87 per cent complete to date):				
During year.....	995	1,182	3,438	4,082
To date.....	22,182	22,182	22,182	22,155
Pedro Miguel Locks, 13,823 feet rack section (99 per cent complete to date):				
During year.....	1,086	1,518	3,901	3,901
To date.....	13,712	13,706	13,696	13,696
Miraflores Locks, 18,360 feet rack section (98.8 per cent complete to date):				
During year.....	3,894	4,007	8,160	9,104
To date.....	18,144	18,144	18,144	18,144

From the above tables it is noted that 99.3 per cent of the 54,365 feet of rack section required for all locks is completed.

Conductor slot material.—The progress of the work of installing steel and copper conductor rails, insulators, brackets, and cover plates is indicated by the following table:

	Gatun.	Pedro Miguel.	Mira-flores.
Steel bar during year.....	4,967	8,435	5,414
Copper bar during year.....	7,518	13,325	16,818
Total.....	12,485	21,760	22,232
Steel bar to date.....	18,103	15,097	10,654
Copper bar to date.....	26,981	21,196	17,503
Total to date.....	45,084	36,293	28,162

During the past year there has been installed a total of 56,477 feet of conductor slot, or a total of 109,539 feet to date, comprising the requisite material for completing the conductor slots. Owing to a shortage of material, it has been necessary to place an order for a small amount of additional material, most of which will be installed on the approach walls at Miraflores.

Conductor slots.—The procedure followed in installing the conductors in the conductor slots has been to use the copper tee rails upon all towing tracks, inclines, and crossovers, the steel conductor being used upon the return tracks only. Tests made upon the towing locomotives indicate that the design of the conductor slot material will take care of every load requirement of the machines, the voltage regulation being quite satisfactory under every condition of operation.

Crossovers and turnouts.—The installation of single and double crossovers and turnouts has been completed during the past year, as follows:

Gatun Locks, completed March 2, 1914; Pedro Miguel Locks, completed January 28, 1914; Miraflores Locks, completed May 2, 1914.

TOWING LOCOMOTIVES.

Under date of May 24, 1913, a contract was entered into with the General Electric Co. for furnishing 40 towing locomotives of their design and manufacture. The total contract price for the machines was \$527,015, the first locomotive to be delivered January 15, 1914, and four locomotives to be delivered each month thereafter. Twenty-one locomotives have been delivered to date and appear to be operating satisfactorily.

I am attaching a curve (plate No. 85) showing the current duty cycle for one locomotive ascending and descending the west side wall incline at Miraflores.

Distribution of locomotives.—The original plan of distributing the locomotives at the locks was as follows:

	Lock walls.			
	West.	Center.	East.	Total.
Gatun.....	4	8	4	16
Pedro Miguel.....	2	4	2	8
Miraflores.....	4	8	4	16

As this distribution did not provide for six locomotives on one lock at Pedro Miguel, arrangements are being made to distribute the machines as follows:

	Lock walls.			
	West.	Center.	East.	Total.
Gatun.....	4	8	4	16
Pedro Miguel.....	2	5	3	10
Miraflores.....	3	7	4	14

SPILLWAY-GATE MACHINES.

The spillway-gate machines were all delivered during the fiscal year ending June 30, 1913, the dates of completion for the mechanical and electrical erection being as follows:

Lock.	Number of machines.	Mechanical work completed—	Electrical work completed—
Gatun.....	14	Sept. 28, 1913	Dec. 18, 1913
Miraflores.....	8	Oct. 13, 1913	June 5, 1914

Twenty-two machines completed June 5, 1914.

Tests and operation.—The spillway gates at Gatun have all been operated under full head, although only seven gates have been opened at one time. Their operation has been satisfactory, the gates being operated from the switchboard in the hydroelectric station.

LOCK TRANSFORMER ROOM EQUIPMENT.

Practically all the material for the transformer rooms was received in the fiscal year ending June 30, 1913, the erection work having the following status at the present time:

	Installed.				Bus bars installed and connected.	Bells installed and connected.		Electrical work.	
	Power transformers.	Light transformers.	Oil switch bank.	Low-tension switch-board.		Low tension.	High tension.	Started.	Completed.
Gatun, 16:									
During year	17	4	5	6	6	16	16	16	0
To date.....	32	16	16	16	16	16	16	16	0
Pedro Miguel, 8:									
During year	14	4	6	6	5	8	8	4	0
To date.....	16	8	8	8	8	8	8	0	8
Miraflores, 12:									
During year	1	12	12	11	12	12	12	10	4
To date.....	24	12	12	12	12	12	12	8	4

Two power transformers in each room.

Special transformer room equipment.—In order to provide for the lock-control boards some special transformers and switching equipment similar to that used in the main transformer rooms were purchased. The lock-control boards require 25-cycle single-phase current at two pressures, namely, 110 and 230 volts. The 110-volt pressure is used for supplying current to all indicating lamps and mechanisms, the 230-volt pressure being used for the control circuits to contactor panels in the lock tunnels. Gatun control board being the largest, was taken as a standard, its power requirement under the worst condition being approximately 10 kilowatt volt amperes at 230 volts and 56 kilowatt volt amperes at 110 volts. The transformer used has a capacity of 66 kilowatt volt amperes, a 110 and 120 volt set of windings being connected in series with taps taken out for the specified pressures.

In order to provide for interchangeability, all transformers for all locks are of the same size, two machines being installed adjacent to each lock-control house. The switch bank used in connection with the transformers is made of six oil switches, each switch bank being a standard transformer room oil switch bank, modified to suit the conditions. At the present time the work upon the rooms is practically complete at all locks.

INSULATED CABLE.

The total amount of cable on order received and installed up to the end of the present fiscal year is 2,659,403 feet, of which 1,531,528 feet is lead sheathed and 1,127,875 feet is rubber-covered double-braid wire and cable. All cable has been received except 40,500 feet of No. 6 rubber-covered double-braid wire, the delivery being 99 per cent complete. To date 1,462,684 feet of lead-covered cable has been pulled into the ducts and 911,816 feet of rubber covered has been used for the conductor slot feeds, control connections, etc.

The following table will give an idea of the amount of wire and cable installed:

Feet installed.	Purchased.	Pulled during year.	To date.
No. 6 B. & S. 1/c rubber insl. ld. sheathed	50,000	49,560	49,560
10 B. & S. 1/c rubber insl. ld. sheathed	41,300	35,053	35,053
6 B. & S. 1/c var. cambric ld. sheathed	4,000	2,545	3,993
6 B. & S. 1/c rubber insl. double brded	174,500	101,761	101,761
10 B. & S. 1/c rubber insl. double brded	204,000	172,666	172,666
12 B. & S. 1/c rubber insl. double brded	410,722	377,729	383,729
2 B. & S. 1/c rubber insl. ld. sheathed	98,014	79,698	93,247
2 B. & S. 1/c var. cambric ld. sheathed	51,000	33,158	50,982
12 B. & S. 1/c rubber insl. ld. sheathed	62,020	36,801	36,801
00 B. & S. 1/c var. c. insl. ld. sheathed	30,800	19,632	27,592
12 B. & S. dpl. r. insl. 1 braid each cdr. 1 brd. over all twisted	72,649	52,773	52,773
12 B. & S. dpl. cable r. insl. ld. shd. flat	48,022	33,662	33,982
61-#23 B. & S. 1/c r. insl. dbl. brded. concentric strand	106,000	84,756	84,756
19-#23 1/c r. insl. dbl. brded. concentric strand	120,004	109,201	109,201
1 million c. m. 1/c var. c. insl. ld. cvrd.	1,125	1,094	1,094
750,000 c. m. 1/c var. c. insl. ld. cvrd.	1,000	1,000	1,000
0000 B. & S. 1/c var. c. insl. lead covered	8,300	2,459	2,594
No. 00 B. & S. over all dia. 1.74"	69,800	25,121	64,700
No. 0000 B. & S. over all dia. 2.04"	318,987	201,484	298,222
5 conductor No. 10 B. & S. gauge	281,738	168,314	281,322
8 conductor No. 10 B. & S. gauge	452,182	254,102	452,090
500,000 C. M. 3/c var. c. lead sheathed	5,240	4,326	4,937
500,000 C. M. single track cable	40,000	25,820	25,820
No. 19 5 pair telephone cable	8,000	6,625	6,625
Total	2,659,403	1,879,340	2,374,500

Feet of cable installed up to and including June 30, 1914.

	Lead covered.	Rubber insulated, double braid.
Gatun Locks	638,398	374,600
Gatun hydroelectric station and spillway	31,756	39,580
Pedro Miguel Locks	364,626	214,291
Miraflores Locks	427,904	283,345
Total	1,462,684	911,816

Total lead-covered cable installed to date	Feet.
Total rubber-covered cable installed to date	1,462,684
	911,816
Grand total installed to date	2,374,500
Cable installed previous to June 30, 1913	495,160
Cable installed during fiscal year	1,879,340
Total amount of cable installed to date	2,374,500

CHAIN-FENDER MACHINES.

After the tests had been completed upon the two sample chain-fender machines the results indicated that the machines would carry out the work for which they were designed, and arrangements were made to order the balance of the equipment. The General Electric Co. was awarded the contract for the 70 horsepower motors, the contactor panels, valve-operating mechanisms, and limit switches. The A. S. Cameron Steam Pump Works received the award for the 5-inch two-stage volute pumps, all of the equipment being on hand and ready for installation. The chain-fender machines proper were ordered of the United Engineering & Foundry Co., the valves being furnished by the Ross Valve Manufacturing Co.

The status of these contracts is as follows:
Cylinders, eyebars, etc., for 46 machines received complete.
Structural steel work for 46 pits received complete.
Operating valves for 46 pits received complete.
Piping and fittings for 46 pits received complete.
Mechanisms for pumps for 46 pits received complete.
Bronze resistance valves, 45 (sets of 2) received complete.
Eighteen chains have been ordered to date, of which the following have been received: 10 pieces of section No. 1; 6 pieces of section No. 2; 3 pieces of section No. 3; 1 piece of section No. 4; 1 piece of section No. 5; and one piece of section No. 6. There remain five chains to be purchased in order to complete the machines.
The following progress has been made in the erection of the mechanical parts of the machines:

	Gatun, 16 machines.			Pedro Miguel, 16 machines.			Mirafleres, 16 machines.		
	Re-ceived.	Part in-stalled.	In-stalled com-plete.	Re-ceived.	Part in-stalled.	In-stalled com-plete.	Re-ceived.	Part in-stalled.	In-stalled com-plete.
During year.....	16	2	¹ 14	16	9	¹ 7	16	15	¹ 1
To date.....	16	2	¹ 14	16	9	¹ 7	² 16	15	¹ 1

¹ Except chains. ² Except one set of operating valves.

The electrical work upon the chain-fender machines has progressed as rapidly as the mechanical work would permit, the progress of the work at the present time being as follows:

	Motors con-nected.	Limit switch.		Local indi-cator erected.	Valve-oper-ating mech-anism in-stalled and con-nected.	Contactor panel.		Electrical work.	
		In-stalled.	Con-nected.			In-stalled.	Con-nected.	In-stalled.	Com-pleted.
Gatun, 16 machines.....	3	16	3	2	4	10	3	13	.....
Pedro Miguel, 16 machines...	2	7	2	.....	.....	7	2	16	.....
Mirafleres, 16 machines.....	.....	.....	.....	.....	.....	3	.....	12	.....

HAND-RAIL OPERATING MACHINES.

All machines have been received and installed complete, the erection work being completed upon the following dates:

	Mechanical.	Electrical.
Gatun, 36 machines.....	Nov. 29, 1913	Mar. 21, 1914
Pedro Miguel, 20 machines.....	Dec. 26, 1913	Mar. 3, 1914
Miraflores, 24 machines.....	May 29, 1914	May 28, 1914

All the hand-rail machines have been operating satisfactorily on the local and automatic control circuits.

CHAIN-FENDER SUMP PUMPS.

All chain-fender sump-pump motors have been received, the installation being limited by the work in the chain-fender pits, the work being 40 per cent complete on this date. The progress of the work is as follows:

Mechanical.

	Gatun, 16 pumps.			Pedro Miguel, 16 pumps.			Miraflores, 16 pumps.		
	Re-ceived.	Part in-stalled.	In-stalled.	Re-ceived.	Part in-stalled.	In-stalled.	Re-ceived.	Part in-stalled.	In-stalled.
To date.....	16	12	4	16	7	9	16	8	

Electrical.

	Motors con-nected.	Starting panels.		Float switch.		Electrical work.	
		In-stalled.	Con-nected.	In-stalled.	Con-nected.	Started.	Com-pleted.
Gatun ¹	4	4	4	4	4	4	0
Pedro Miguel ¹	0	3	0	1	0	16	0
Miraflores ¹	0	3	3	3	0	16	0

¹ Motors, float switches, and electrical work for 16 machines.

Some of the chain-fender sump-pump motors have burned out, due to operating them continuously during construction work, the motor being rated for intermittent operation only.

DRAINAGE SUMP AND CULVERT PUMPS AND MOTORS.

All pumps and motors have been received, the erection work being finished upon the following dates:

	Mechanical.	Electrical.
Gatun, 4 pumps and motors.....	June 14, 1913	98 per cent complete. 4
Pedro Miguel, 4 pumps and motors.....	Oct. 20, 1913	June 9, 191
Miraflores, 4 pumps and motors.....	Aug. 28, 1913	Do.

NOTE.—One pump at Gatun has not been equipped with its float switch and a portion of the electrical connections must be completed.

OPERATING TUNNEL DOORS.

All of the operating tunnel doors have been received and are installed complete for all locks.

ILLUMINATION.

Last year's report contains a brief description of the proposed method of illuminating the locks and lock walls. The exterior lighting is accomplished by single and double arm, reinforced concrete, lighting standards, each of which has an over-all height of 34 feet 4 inches and is designed to withstand a wind pressure of 35 pounds per square inch. The single-arm standards are located in a staggered position upon the center wall, the double-arm standards being used for side-wall illumination. The reflector is hood shaped to give a cut-off line approximately as indicated upon plate No. 87 attached, which is taken on a horizontal plane 3 feet 6 inches above the towing track. The spread of the lamps on the double-arm bracket is 8 feet 6 inches, while that of the single arm is 4 feet 3 inches. The lamp standards are located on the center wall in a staggered line upon 50 to 60 foot centers, upon 100-foot centers on the side walls, and are equipped with one or two 500-watt tungsten lamps, depending upon whether the standard has a single or double arm bracket.

A test of the illumination at Gatun Locks was first made on the evening of March 11, 1914, when the west side wall and center walls were illuminated. The east wall at Gatun was first lighted up and put into service in April, and several tests have been made to determine the relative value of the illumination. Plates Nos. 88, 89, and 90, attached, indicate the results obtained under various conditions. All curves are based upon values taken at an elevation 3 feet 6 inches above the level of the towing track.

At the present time the exterior lighting circuits at all locks have been completed except for five posts to be installed at Miraflores. The total number of lamp standards at all locks is indicated in the following table:

	Single-arm.	Double-arm.	Total.	Total installed to date.
Gatun.....	116	90	206	All.
Pedro Miguel.....	80	50	130	All.
Miraflores.....	101	67	168	All but 5 double-arm bracket standards.
Total.....	297	207	504	

LOCKAGES.

Perhaps the most important event of the year was the filling of the west flight of Gatun Locks on September 25, 1913. The first step in the filling operation was to fill the space between the upper guard and upper operating gates. This was done by means of the 60-inch auxiliary culvert valve in the west wall, the valve being opened at 9.07 a. m. and kept in this position until about 3.30 p. m. It was necessary to close the valve twice during this period in order to clear vegetation from the trash screen at the intake. The second operation was the filling of the culvert in the center wall and valves and bulkheads as well as the culvert itself.

The upper section only was filled at first, and then after opening the rising-stem valve at the upper end, this water was used to test the center culverts of the three levels successively, the water finally being discharged into the lower lock by opening the cylindrical valves in that level.

On September 26, 1913, preparations were made for removing the bulkheads from the upper end of the west culvert. In order to remove the bulkhead it was necessary to equalize the pressure of the lake by back pressure upon the lower side of the bulkhead, and this was accomplished by introducing water into the upper end of the upper lock, the bulkhead being removed at 10 a. m. At 11.20 a. m. water was admitted to the upper end of the upper lock from the west culvert, through the upper rising-stem gate valves, and by this means the water was brought up to the lake level.

The upper rising-stem valves were then closed and the water in the upper chamber was brought to lake level in the upper lock as a preliminary test of the valves and culverts of the west wall. The water was then locked down step by step from the lake to the lower lock, which was also being filled by two 14-inch sea valves in the lower guard gates.

Up lockage of tug "Gatun."—At 4.45 p. m. the lock had filled to sea level and the lower gates were opened for the tug *Gatun*. The lower operating gates were closed behind the tug and she was lifted step by step to Gatun Lake level. In order to save time in the ascent, the short length of lock was used in the first lock, the tug being raised from elevation plus 0.8 to elevation plus 12, a lift of 11.2 feet. In the middle lock it was raised from elevation plus 12 to elevation plus 35.7, a lift of 23.7 feet. In the upper locks she was raised from elevation 35.7 to elevation 65.5, a lift of 29.8 feet. The total lift from the first lock to Gatun Lake level was 64.7 feet. The time of ascent was 1 hour and 51 minutes. At 6.45 p. m. the upper gates were closed behind the tug and it passed into Gatun Lake. During the lockage operations, all operating devices were operated from the local control switches upon the contactor panels.

Return lockage of tug "Gatun" from Gatun Lake to sea, September 27, 1913.—The water level in the upper end of the lock was at elevation 64.13 feet and in the lower end was at elevation 34.6 feet. The two ends were equalized by opening rising-stem gate valve No. 254, the water being equalized at 29 feet over the sill or at elevation plus 44. At 8.35 a. m. rising-stem valve No. 260 was opened and the chamber filled to lake level. Gates 21 and 32, 39 and 40 were opened during the period when the water was equalizing, and at 8.58

a. m. gates Nos. 35 and 36 were opened, and the tug *Gatun* entered the upper locks. Gates 35 and 36 were then closed, as were rising-stem gate valves Nos. 260 and 261. Gates 39 and 40 were also closed, and during this period rising-stem gate valves Nos. 236 and 237 were opened, equalizing both ends of the middle lock. At 9.26 a. m. the locks were equalized and rising-stem gate valves Nos. 248 and 249 were opened. While the water was equalizing in the middle and upper locks, gates 19 and 20, as well as 27 and 28, were opened. The water equalized at elevation 46 at 9.43 a. m. Gates 23 and 24 were then opened, and the *Gatun* passed into the middle lock. Gates 23 and 24, 27 and 28, and rising-stem valves 248 and 249 were closed. At 9.44 a. m. rising-stem valves 232 and 233 were opened, and at 10.06 a. m. the water had equalized at elevation 23.6 feet, and gates 15 and 16 were opened for the passage of the *Gatun* into the lower lock. Gates 15 and 16 and rising-stem valves 232 and 233 were then closed. At 10.10 a. m. rising-stem valves 216 and 217 were opened, and at 10.28 the water had equalized with the sea, which was at elevation 0.6. At 10.30 gates 7 and 8 were opened, and the tug *Gatun* passed out to sea. The gates 7 and 8, 3 and 4 were then closed, and the lockage was completed.

The change in water elevations in the locks was as follows: Upper lock, 65.47 to 46, a fall of 19.47 feet; middle lock, 46 to 23.6, a fall of 22.4 feet; lower lock, 23.6 to 0.6, a fall of 23 feet.

The total time of the return trip from Gatun Lake to the sea was 1 hour 30 minutes.

The east lock at Gatun was watered on January 3, 1914. The first vessels to enter the chamber were five submarines, C-1, C-2, C-3, C-4, and C-5, which were locked up and left in the upper lock chamber on March 9, 1914. The vessels entered the lower chamber at 9.08 a. m. and were left in the upper lock at 11.07 a. m.

The Gatun Lock control board was tried out on May 9, 1914, when all valves, gates, and machines were operated by remote control. Upon May 11, 1914, the fifty-first lockage took place, and was the first lockage by use of the control switches on the lock-control board. The *La Valley* and tug *Exotic* entered the lower chamber at 7.36 a. m. and left the upper chamber at 8.48 a. m., the total time of the lockage being 1 hour 12 minutes. This lockage was also the first made by means of the towing locomotives which were operated upon the walls of the west chamber, the locomotive numbers being 641, 642, 643, and 644. Since May 11, 1914, all lockages through Gatun Locks have been handled by the towing locomotives, and upon June 8, 1914, the first seagoing vessel, the *Alliance*, entered the lower chamber of the west lock at Gatun.

Lockage of steamship "Allianca."—The *Allianca* is 335 feet long, has a beam of 42 feet, a mold depth of 15 feet, and a gross tonnage of 3,905 tons. Being loaded, she displaced about 9,000 tons at the time of the lockage. The *Allianca* arrived at the locks at 6.45 a. m. and towing began at 7.17 a. m., and the lines were cast off the steamship in Gatun Lake at 8.48 a. m., the total time for the lockage being 1 hour and 31 minutes. The *Allianca* steamed out into Gatun Lake, turned around, and tied up to the approach wall. Dynamometers for recording the towline pulls were then taken aboard and put into the lines of the leading and trailing locomotives, readings being taken

at 10-second intervals. The attached plate, No. 91, is a record of the readings taken at that time. In accelerating a vessel of this size the towline pull is very irregular, and therefore some readings have been omitted on the attached graphical log. An instantaneous maximum pull of 35,000 pounds was noted upon each dynamometer. The accelerating and retarding tests were recorded and noted in the following table:

Operation.	Time.	Distance.	Angle, horizontal.	Angle, vertical.	Amount of cable.	Remarks.
	' "	<i>Feet.</i>	°	°	<i>Feet.</i>	
Accelerating.....	1 1	110	25	+15	150	U. L.
Retarding.....	1 5	75	25	+15	150	M. L.
Accelerating.....	1 30	130	25	-15	150	M. L.
Retarding.....	1 5	130	35	+12	150	L. L.

NOTE.—The negative angle denotes the fact that the locomotive towline was below a horizontal plane taken through the drum of the locomotive.

The *Allianca* was held in the lower lock for 10 minutes after the gates were opened, in order to obviate any possible trouble due to the current resulting from a mixture of fresh and salt water. The *Allianca* was carrying a full cargo and had a draft of 18.2 feet.

A total of 109 lockages have been made at Gatun up to June 30, 1914, including those made in both the west and east locks. The total amount of water used for lockages at Gatun has been 685,454,000 cubic feet.

Lockages at Pedro Miguel.—The east lock at Pedro Miguel was watered at the time the Gamboa dike was blown out. On October 14, 1913, three barges were towed into the lower chamber and the upper valves were left open so that the water would rise in the lock as fast as the water entered Culebra Cut. On October 24, 1913, when the water in the Cut had risen sufficiently, the barges were towed through the locks by hand and left tied to the upper approach wall. The second lockage was made upon this same date, October 24, 1913, when the suction dredge *No. 85*, *Clapet No. 9*, tugs *Miraflores* and *No. 26*, the launches *Louise* and *Birdena*, together with pontoons and pipe for the suction dredge entered the lower chamber at 11.10 a. m. and left the upper chamber at 11.52 a. m., the total time of the lockage being 42 minutes.

The west chamber of Pedro Miguel Locks was watered on the afternoon of December 31, 1913. The pump which had previously been installed in the west chamber of the lock to keep the water level down was operated for the last time at 7 a. m. on December 30, 1913. By January 2, 1914, the water in the chamber was 9 feet over the sill, or 13 feet over the floor of the lock, giving a leakage of about 0.5 of a cubic foot per second. This leakage was obtained with the water in the center-wall culvert at plus 50½. The chamber was filled through the west-wall culvert, the lower pair of valves being closed, as well as the lower operating and safety gates. At 7.50 a. m. one of the upper valves, No. 418, was opened 4 feet, and at 8 a. m. the valve was opened halfway. At 8.50 a. m. on January 2, 1914, the water in the west chamber was at Gatun Lake level, elevation plus 84, and by 9.15 a. m. both bulkheads had been removed from the upper end of the culvert.

The first lockage in the west chamber at Pedro Miguel was made on January 7, 1914, when the crane boat *La Valley*, *Clapet No. 9*, and barge *No. 6* entered through the upper gates at 8.45 a. m. The vessels left the lower end of the lock at 9.36 a. m., the total time of the lockage being 42 minutes.

On March 28, 1914, a dummy lockage was made with the use of the lock control board, the first lockage handled by the remote control switchboard occurring on April 8, 1914, when the launch *Naos* and a log raft entered the lower end of the lock at 10 a. m. The launch and raft were towed through the locks by the towing locomotives and left the upper end at 3.30 p. m., the total time of the lockage being 5 hours 30 minutes. This was also the first time that the towing locomotives had been used for handling craft in the lock chamber at Pedro Miguel.

A total of 70 lockages have been made at Pedro Miguel, the last lockage of the fiscal year being made on June 26, 1914. The total amount of water used at Pedro Miguel has been 266,970,000 cubic feet.

Lockages at Miraflores Locks.—The first lockage of a craft through Miraflores Locks occurred on Tuesday, October 14, 1913, when the *Clapet No. 6*, tug *Miraflores* with three barges, and the steam launch *Birdena* were raised through the west flight from the Pacific level to the surface of Miraflores Lake. The vessels entered the lower chamber at 11.15 a. m. and left the upper chamber at 12.41 p. m., the total time of the lockage being 1 hour 30 minutes. On January 12, 1914, water was let into the upper and lower chamber of the east lock at Miraflores. The operations carried out in watering the locks were similar to those which have been described in connection with the filling of Gatun Locks.

Up to the present date 81 lockages have been made, the last occurring on June 26, 1914, when the *Mariner* was locked up, entering the lower lock at 11.02 a. m. and leaving the upper lock at 11.40 a. m., the total time of the lockage being 38 minutes. The first lockage with the use of the remote control switchboard occurred on June 24, 1914, when the *Mariner*, barges 62 and 64, and derrick barge *No. 1* entered the upper chamber at 8.20 a. m. for a down lockage. The vessels left the lower lock at 9.20 a. m., making the total time of the lockage 1 hour. The total amount of water used at Miraflores Locks up to the present date has been 1,079,369,000 cubic feet.

Lockage of the "Santa Clara."—On June 18, 1914, the first seagoing vessel was locked through the Pacific Locks. The *Santa Clara* is owned by the W. R. Grace Co. and has a total length of 404½ feet, a beam of 53 feet 8 inches, a draft of 26 feet, a gross tonnage of 6,309, and a displacement of 11,000 tons. The general log of the operations is as follows:

The *Santa Clara* arrived at the lower approach of Miraflores Locks at 3.20 p. m. June 18, 1914. The lockage started at 3.38 p. m., the ship entering the lower lock of west flight at 3.42 p. m. and completed her lockage at 4.40 p. m., a total time of 58 minutes. She reached the east lock at Pedro Miguel at 5.10, the lockage starting at 5.18 p. m. and ended at 5.48, making a total time of 30 minutes.

The *Santa Clara* was then turned around in the channel, and on June 19, 1914, she entered the lock at 7.12 a. m., the lines being cast off at the lower end at 7.48 a. m., a total elapsed time of 36 minutes.

The vessel reached the upper approach of Miraflores Locks at 8.07 a. m., the lockage starting at 8.13 a. m., the lockage being completed by 9.55 a. m., a total elapsed time of 1 hour 42 minutes, the delay being due to the discharge of passengers at the lower flight.

Lockage of the steamship "Ancon."—The eighty-fourth lockage at Gatun was made with the second large seagoing vessel, the steamship *Ancon*. The *Ancon* has a total length of 489 feet 5 inches, a beam of 58 feet, a mold depth of 28 feet 9 inches, a gross tonnage of 9,606 tons, and a displacement at time of lockage of 18,000 tons. She entered the lower lock at Gatun on June 11, 1914, at 12.33 p. m. and left the upper lock at 2.18 p. m., the total time of the lockage being 1 hour 45 minutes. She was then turned around in Gatun Lake and entered the upper lock at 3.15 p. m., leaving the lower lock at 5.15 p. m., the total time of the lockage being 2 hours. Her passage through the locks was carried out by means of the towing locomotives without any unusual event of any kind.

EMERGENCY DAMS.

The operation of the emergency dam has been fully described in our previous reports. The dams have all been completed by the contractor and accepted by The Panama Canal upon the following dates:

Gatun, Dam A accepted August 4, 1913.

Gatun, Dam B accepted August 28, 1913.

Pedro Miguel, Dam C accepted October 17, 1913.

Pedro Miguel, Dam D accepted December 6, 1913.

Miraflores, Dam E accepted February 14, 1914.

Miraflores, Dam F accepted January 16, 1914.

Tests.—A number of tests have been made upon the dams, and perhaps one of the most interesting was the determination of leakage under full head.

On May 5 and 6, 1914, Dam A was put into service, the wedges being drawn at 10 a. m. The dam was turned across the channel, the girders and gates being lowered into place, after which the drive pipes were lowered, and the dam was ready for the test. On the morning of May 6 the upper lock was filled to lake level, after which the upper guard and operating gates were opened. The next operation was to lower the level of the water below the dam, and during the operation observations were taken of various parts of the dam, as follows:

1. Clearance between bearing plate of the horizontal girders.
2. Clearance between wedges and wedge seat.
3. Deflections of horizontal girder.
4. Elevation of center point of upstream chord of horizontal truss.

When the head was applied to the dam, the long arm wedge had a clearance of $1\frac{1}{8}$ inches, but as the head was increased this clearance rose to $1\frac{1}{4}$ inches above the wedge seat. When a 40-foot head had been impressed upon the dam the downstream wedge on the long arm lifted entirely off the seat. A full head of 45 feet upon the dam gave a clearance of one-half inch on the downstream and $1\frac{1}{8}$ inches on the upstream wedges of the long arm. The only other wedge not in contact was the upstream wedge at the center of the dam, which remained seven sixty-fourths inch above its seat throughout the test. The wedge clearances are shown graphically on plate No. 92, attached.

Observations were taken upon the downstream chord of the horizontal girder by means of a wire stretched across the lock close to this member, plate No. 93 showing the results obtained.

Observations were also taken with regard to any changes that might occur in the elevation of the center point of upstream chord. These observations were taken with an engineer's level, the results being plotted graphically on plate No. 94, the maximum movement being 0.097 foot for an increasing head and 0.079 foot for a decreasing head.

The leakage of the dam occurred along the drive pipes and at the horizontal joint between the gates. The greatest leakage, however, was at the bottom of the chambers, the water escaping through the girder-seat recesses. The rate of rise in the water level of the lock below the dam is shown graphically on plate No. 95. From this curve it was found that this allowed the passage of 950 cubic feet of water per second. The masonry abutments were examined while the dam was under full head and gave no evidence of being excessively loaded.

After the water had equalized above and below the dam, the upper guard and operating gates were closed, the tests being completed.

TELEPHONE SYSTEM.

The general scheme of the electrical connections of the telephone system of the locks and lock-wall operation is as follows:

Trunk-line connections will be carried into the manhole beneath the control house from the Balboa exchange via the trans-Isthmian telephone cable. These trunk lines will provide for all interconnection with outside departments not taken care of by the local telephone switchboard in the control house. In order to provide for connection between the control house and the lock walls, telephone circuits were carried through the tunnels and taps taken out at each exterior lamp standard upon the side and center walls of the locks. In the base of the standards a telephone outlet box has been provided and porcelain jack buses installed and connected up to the telephone system. All of the circuits connecting the lamp standards are carried to the manhole just beneath the lock-control house, and at that point are brought together in a telephone junction box provided for the purpose. In order to provide for telephone connection with the machine rooms in the tunnels, individual lines are run to each transformer room from the lock-control house. We have also installed a line between the control house and each emergency dam, and another line is carried to the spillway machinery tunnel at both Gatun and Miraflores. All trunk lines and other incoming telephone cables are brought together in the manhole under the lock-control house where they are connected in on the 40-pair moisture-proof junction box, and lead-covered cable is run from this point up to the telephone racks, and relay boards on the mezzanine floor of the control house.

Telephone equipment.—The Western Electric Co. has been awarded the contract for furnishing the complete telephone equipment which will be required for the operation of the locks. This material is being manufactured in the United States at the present time and is due for complete delivery by November 26, 1914. The equipment may

be divided into several subdivisions; first, that which will be required for the control of vessels passing through the locks; second, that which will be required in the upkeep and maintenance work in the lock tunnels; and third, the equipment required for local public service.

Arrangements have been made to purchase three complete telephone central office equipments, each outfit consisting of a telephone switchboard, together with all of its necessary accessories for the satisfactory operation of the board, including the coil racks, distributing frames, line-protection equipment, storage batteries, battery cabinets, mercury arc rectifier, charging equipment, and the necessary cables for connecting up the complete installation. Each switchboard is to be constructed of solid mahogany and is to be equipped with the necessary plugs and jacks for caring for 30 subscriber's outfits, 4 incoming trunk lines, 5 plug-ended trunk circuits, 1 line pilot circuit, 1 night alarm circuit, 10 operator's coil circuits, and 2 control operator's circuits, together with 1 operator's ringing telephone set. Each circuit is to be equipped with double-lamp indication, 1 lamp for the answering cord and 1 for the calling cord. These circuits are to be used for obtaining connection with the transformer rooms, emergency dams, lock superintendent's offices, public telephone on first floor of control house, as well as taking care of the incoming trunk-line calls.

The control-board operator's circuit is to be connected on telephone jacks located in each 4-foot panel of the control switchboard, and so arranged that the control-house operator may plug in with his portable set and obtain direct connection with the telephone outlets in the exterior lamp standards, or by indirect means he may obtain connection through any trunk line or subscriber's connection. If one of the superintendents wishes to get into connection with the control-house operator he plugs in with a portable hand set which is being provided for him, and immediately lamp indication will be given in the control house, and the control-house operator is expected to answer the call, either from his position at the lock-control board or through the telephone switchboard transmitter.

In addition to the telephone jacks which are to be installed in each 4-foot panel of the lock-control board for the use of the control-house operator, we are arranging to install telephone jacks just beneath the second-floor level and immediately adjacent to the terminal boards of the control board. These jacks will be used by any of the maintenance men or repair men who may find it necessary to keep in communication with the lock-operating tunnels through the transformer rooms.

If the control-house operator desires to get into touch with the superintendent of locks upon the lock wall, provision is to be made by which he can operate a "howler," located upon the roof of the lock-control house, by means of which we expect to be able to transmit sound to a distance of 4,000 feet from the lock-control house. The lock superintendent, upon hearing the signal from the control house, can plug in at one of the lamp standards and by this means get into touch with the control-house operator.

We are also arranging to purchase iron-case telephone boxes, one of which will be installed in each transformer room of the lock-operating tunnels. Adjacent to each of these telephone boxes we

expect to install either large, loud-ringing extension bells or a small "howler" similar to that used for calling the lock superintendent from the control house. If the operator wishes to get into communication with one of the men in the operating tunnel, we expect to reach him by means of calling with the loud-ringing bells (or "howlers," as the case may be). We are to obtain one sample of the loud-ringing bells and one of the "howlers," and a test will be made to see which of the devices will be more satisfactory for calling the men in the tunnels.

Each of the telephone boxes in the transformer rooms are to be equipped with telephone jacks in the base of the boxes, so arranged that a maintenance man may plug in with a portable hand set which has been provided with an extension cord 200 feet long. By this means we expect to be able to provide communication between any one of the machines in the operating tunnels and the control-house operator, lock superintendent, or, in fact, any point upon the telephone system, if such connection is required.

LOCK-CONTROL SWITCHBOARDS.

The General Electric Co. was awarded the contract for furnishing the lock-control switchboards for Gatun, Pedro Miguel, and Miraflores Locks. The original specifications of the Commission were departed from as to the general construction of the board, and also with regard to the method of accomplishing the required interlocking of the control switches. The detail design of the board was left entirely to the contractor, the work being subject to the approval of The Panama Canal's inspection office in the United States.

At each flight of locks and at the top of the upper center wall incline we have constructed the lock-control houses. The switchboards occupy the second floor of the building, the mezzanine floor being used for the installation of the interlocking racks and incoming five and eight conductor control cables. The switchboard level of the control house is 29 feet 3 inches above the lock-wall coping, in this way giving the operator an excellent view of the entire flight of locks under his control. The control boards are designed to represent the locks in miniature, all machines being represented by individual-control switches, and wherever it is important for the operator to know the exact position of the machines being controlled, indicators have been provided which operate in synchronism with the machines in the lock-wall tunnels. The over-all width of the board is 5 feet 4 inches in every case, the top of the board being 2 feet 9 inches above the floor. In order to represent the lock chambers two parallel strips of blue Vermont marble have been run the entire length of the board, the center and two side walls being represented by cast-iron panels with raised bosses for mounting the control switches. The over-all lengths of the boards are as follows: Gatun lock-control board, 64 feet over all; Pedro lock-control board, 32 feet over all; Miraflores lock-control board 52 feet over all.

The principal point of interest in connection with the lock-control boards is the means by which the operator is informed of the exact position of the machine being controlled. Certain of the machines have a very short period of operation, as is the case with the cylindrical valve, auxiliary culvert valve, and miter forcing machines.

all of which operate from an open to a closed position in less than 10 seconds. It would be of very little advantage to the operator to be able to follow the operation of these machines, and therefore the use of red and green lamp indication has been adopted, the lamps being mounted adjacent to their respective control switches. All of the remaining lock equipment operates in a period varying from 50 seconds to over 2 minutes, and as each of the machines controlled is very massive it is of importance that the switchboard operator have definite information throughout the cycle of operation with regard to the exact position of the valve or machine being operated. This switchboard indication is accomplished by means of synchronous indicators which are electrically connected with transmitting devices mechanically connected to the large machines in the lock tunnels. The transmitting device is geared to the machine to be operated and any movement of the machine drive is immediately transmitted to the indicator on the lock-control switchboard. The indicators in every case are mounted above the switchboard and wherever possible are made so that they may be plainly seen from either an up or down stream position at the board.

The chain-fender indicator consists of a small aluminum chain hung between two small semaphores and so arranged that it will be stretched taut across the switchboard when the large chain in the lock chamber is in that position. When the chain-fender machine is operated and the large chain is lowered to its recess in the bottom of the lock chamber each of the small semaphores operate synchronously with their respective chain-fender machines and the miniature chain is gradually dropped into a recess in the top of the switchboard.

For the indication of the position of the rising-stem gate-valve and guard-valve machines indicators have been provided, which project above the switchboard approximately 14 inches. The up and down stream sides of the indicators are provided with opal glass sides, and lamps are arranged underneath the surface of the board in such a manner that they will project their light up into the indicator. A car is hung within the indicator and is raised and lowered in synchronism with the valve being operated. The bottom of the car has been provided with two reflectors, which are so arranged that they will throw a beam of light up and down stream from the indicator. The two opal glass openings are intended to represent the openings in the large valves of the culverts, and the open position of the valves in the culvert is indicated by the lighted portion of the opal glass—that is, if one of the valves is half open, the upper half of the opal glass will be dark and the lower half will be lighted up.

The indicators for the miter gate-moving machines are made up to resemble a plan view of the miter gate leaves and are so arranged that whenever the gates are in their mitered position the indicators will be swung across the switchboard. When the gates are opened the small indicators move gradually, following the relative position of the large miter gates until they disappear in a small recess similar to the recess in the lock walls.

The most accurate indicator provided for the switchboard is that used in connection with indicating the water levels in the lock chambers. These indicators are high stacks, some of them rising approximately 5 feet above the surface of the switchboard and each of them provided with vertical scales upon their up and down stream sides.

These scales are protected by clear glass and arranged so that the operator may plainly note the position of the two floats, which move up and down the interior of the index with the rise and fall of the water level in the lock chambers. There are two separate and distinct indicator floats, which are used as a check upon each other, so that the operator may be assured of the correct indication of the device. The float well indicators indicate the level of the water in the lock chambers with an accuracy within one-twentieth of 1 foot, the 1-foot scale units of the indicator being divided into tenths.

In addition to the indicators which have been provided for the operator's information, the boards are provided with a means by which the operator is prevented from making an erroneous operation in the control of the locks. A system of interlocking dogs and bars are mounted beneath the switchboard and are so arranged and interconnected that it is impossible for the operator to make an error in carrying out the proper sequence of lock operations.

The lock control boards have all been completed, the erection work being carried out as follows:

	Started.	Completed.
Gatun.....	Oct. 27, 1913	May 9, 1914
Pedro Miguel.....	Dec. 8, 1913	June 26, 1914
Miraflores.....	Feb. 3, 1914	June 25, 1914

The switchboards of all locks have been used for remote control of the lock operations, the Gatun control board being put into service on May 9, 1914, when a test lockage was made, all of the valves and gates of the west chamber being operated. On May 11, 1914, the first remote control lockage was made, and on the same day the electric towing locomotives were first used for the control of vessels passing through the locks.

The lock-control board of Pedro Miguel was first used on February 8, 1914, when miter gates 50 and 51 were opened and closed. The first test lockage was made on March 28, 1914, the first actual lockage occurring on April 8, 1914, towing locomotives 666, 668, and 669 being put into service at the same time.

The lock-control switchboard at Miraflores was put into actual service on June 24, 1914, lockage being carried out by the towing locomotives which had been in service since May 16, 1914.

SUMP PUMPS FOR CRISTOBAL AND BALBOA SUBSTATIONS.

We have arranged to purchase two sump pumps complete for the drainage of the substation buildings at Balboa and Cristobal. The machines are under construction in the United States at the present time and are to be delivered on or before September 1 of this year.

SNUBBING POSTS.

In order to provide for additional snubbing posts, which have been found to be necessary in the control of vessels at the different locks, we have arranged to purchase 207 type B snubbing posts and

26 type A snubbing posts. Twenty-two of the type B and 26 of type A snubbing posts will be used in providing for the shore connections of the floating caisson. The balance of type B snubbing posts will be installed along the lock walls wherever they have been found to be required.

PUMPS AND MOTORS FOR CABLE CROSSEOVERS.

After the lock chambers had been watered it was found that the cable crossover tunnels leaked sufficiently to keep the water at a high level, necessitating the frequent use of the portable sump pumps, which had been provided for the purpose of draining the tunnels. In order to guard against the breakdown of the cables crossing the locks, it was believed advisable to install permanent pumps of sufficient capacity to take care of the leakage and keep the tunnels dry. For this purpose 16 motors and pumps have been purchased. Four of the pumps will discharge 25 gallons of water per minute against a head of 130 feet, and 12 of the pumps will discharge 25 gallons of water per minute against a head of 100 feet. The complete equipment is due to be delivered on or before November 7, 1914.

The rough draft of this report was read over by Mr. Edward Schildhauer, electrical and mechanical engineer, and is submitted in his absence.

Respectfully,

C. J. EMBREE, *Assistant Engineer.*

Col. H. F. HODGES, United States Army,
Engineer of Maintenance, Culebra, Canal Zone.

APPENDIX A-2.

REPORT OF THE RESIDENT ENGINEER, DIVISION OF MUNICIPAL ENGINEERING.

GATUN, CANAL ZONE, *July 15, 1914.*

SIR: I have the honor to submit the following report of the operation of the division of municipal engineering during the fiscal year ending June 30, 1914:

The division was created July 16, 1913, in accordance with the provisions of general circular 183-W, consolidating the division of public works and the municipal work in the three construction divisions, and placed in charge of a resident engineer reporting to the chairman and chief engineer of the Isthmian Canal Commission. Effective April 1, 1914, in accordance with general reorganization orders of that date, it became a part of the department of operation and maintenance of The Panama Canal.

The division is charged with the maintenance within the limits of the Canal Zone of all roads, streets, sewers, water lines, and, since July 16, with air lines, and excepting within the limits of the new town of Balboa, with the construction of same; with the operation and maintenance of all pump stations and water-purification plants; the inspection of plumbing, with the construction and maintenance of sanitary ditches; and with the design and construction of the new waterworks and purification plants for the southern and northern end of The Panama Canal. It is also charged with the maintenance and construction of streets, roads, sewers, water lines; supervision and inspection of plumbing; and the collection of moneys from water rentals within the cities of Colon and Panama.

The division is divided into five principal subdivisions or sections, viz, northern district, southern district, waterworks for the southern end of The Panama Canal, filtration plants and water supplies, and designs.

The northern district, in charge of E. H. Chandler, superintendent, includes all municipal construction, maintenance, and operation work, exclusive of operation of filtration plants, from and including Colon to Darien.

The southern district, in charge of D. E. Wright, superintendent, embraces similar work from Darien to Balboa, including the city of Panama.

Waterworks for the southern end of The Panama Canal, in charge of W. J. Spalding, assistant engineer, covers the construction of the purification works at Miraflores; pumping stations at Gamboa, Miraflores, and Ancon; reservoirs; and the laying of new mains.

Purification plants and water supplies, in charge of James T. B. Bowles, physiologist, until May 21, 1914, and to date in charge of

E. J. Tucker, acting physiologist, covers the operation and care of filtration plants and the care and analyses of all Canal Zone water supplies.

Designs covering all work of this character in the division are handled under the immediate supervision of the resident engineer, with Mr. T. C. Morris, assistant engineer, in charge of the drafting room.

NORTHERN DISTRICT.

The work of the division in this district consisted of the usual maintenance work on water and sewer systems and roads and streets and the operation of pump stations, in addition to several more or less extensive special pieces of work that were authorized from time to time.

The resurfacing of the Mount Hope-Gatun Road, which was commenced in the last fiscal year, was completed in October, 1913. This work was performed by this division at the expense of the Canal Zone government. Minor repairs were made to other macadam roads and streets in the district from time to time as required. A new macadam street was constructed in Cristobal, leading to the new terminal docks of the Panama Railroad Co.

All the sewer mains in the district outside of the city of Colon were flushed twice each month during the year; frequent inspections and tests of valves and fire hydrants were made, to see that they were kept in good serviceable condition.

A 4-inch water main was installed along the beach road in Colon, to provide better water service to the Panama Railroad Co. houses in that reservation; an intercepting sewer was also constructed at that point to provide suitable outfalls for the sewers from the Panama Railroad houses that are not connected with the sewer system of Colon. This work was all performed at the expense of the Panama Railroad Co. Permanent water mains for water supply and fire protection were laid to the new terminal docks in Cristobal.

Sanitary ditches in this district were cleaned and maintained by the division; a total of approximately 400,000 linear feet being cleaned during the year upon request of district inspectors of the health department.

This part of the Colon improvements upon which work was in progress at the beginning of the fiscal year was completed early in August, 1913, and no additional work in Colon has been undertaken under authority of the \$800,000 appropriation. As a part of the maintenance work in Colon the D Street storm sewer was cleaned out in August. The sewage pumping station was operated continuously throughout the year.

The number of individual water connections in use in the city of Colon on June 30, 1914, was 947, with 38 applications pending, an increase of 76 over the number in use at the beginning of the year. The total amount of water rentals collected from individual consumers in Colon during the year was \$94,962.80, and the bills rendered against the Panama Government to cover deficiencies for the first three quarters of the year amounted to \$9,156.90.

The plant at Gatun for the manufacture of concrete pipe was operated until May, when a sufficient stock of pipe had been accumulated to warrant closing down the plant. During the year 3,748

feet of 24-inch and 5,307 feet of 20-inch pipe, or a total of 9,055 feet, was manufactured, of which 3,153 feet was used by this division in municipal work and 2,668 feet furnished other divisions or to individuals and companies.

The usual maintenance work in connection with the reservoirs in this district was performed. The following statement gives the consumption of water from each of the two reservoirs and the elevation of the surface of the water on the last day of each month during the year, together with the amount of rainfall at each point:

	Brazos Brook.			Agua Clara.		
	Consump- tion.	Eleva- tion.	Rainfall.	Consump- tion	Eleva- tion.	Rainfall.
1913.						
July.....	88,511,000	40.7	11.51	76,000,000	59.8	15.99
August.....	79,122,000	43.5	17.03	69,276,000	62.5	12.36
September.....	74,857,000	43.5	11.96	59,184,000	63.4	7.97
October.....	79,993,000	46.5	17.85	61,977,000	68.2	16.48
November.....	88,078,000	49.9	21.32	49,526,000	68.2	19.81
December.....	96,388,000	49.9	12.52	43,937,000	68.2	10.71
1914.						
January.....	94,426,000	48.3	.97	39,729,000	66.7	.77
February.....	78,923,000	49.0	2.46	35,840,000	65.1	1.85
March.....	103,696,000	48.8	1.21	43,691,000	63.0	1.07
April.....	117,516,000	48.5	6.05	40,598,000	61.6	5.75
May.....	119,652,000	48.4	13.37	44,049,000	63.0	13.03
June.....	120,251,000	48.3	15.89	40,423,000	66.2	14.32

The level of the water in the Brazos Brook Reservoir was kept at about the same point during the dry season by letting water down from Gatun Lake through the tunnel, which was mentioned in the last annual report as a part of the new Colon waterworks system.

The two pump stations in this district were maintained and operated as usual. An average of 95,118,000 gallons per month was pumped at Mount Hope, and an average of 50,353,000 gallons per month at the Gatun waterworks, Agua Clara. The new pump station at Mount Hope was completed and placed in service on February 23, and has been operated continuously since that date.

The new water-purification plant at Agua Clara, a part of the waterworks for the town of Gatun, was successfully operated throughout the year. A description of this plant was given in the annual report for the year ending June 30, 1913. (See plate No. 16.)

The new water-purification plant located at Mount Hope, and furnishing water to the city of Colon, Cristobal, and adjacent district, was completed and placed in service in February, 1914, and has been successfully operated since that date. A general description of this plant was given in the annual report for the last fiscal year. (See plates Nos. 17 and 18.)

SOUTHERN DISTRICT.

In the southern district, which includes all points south of Frijoles, the division performed the usual maintenance work on streets and roads and water and sewer systems, which included the taking up of a great deal of water pipe in towns on the west side of the canal

that were inundated by Gatun Lake or for some other reason abandoned during the year. The pipe recovered in this way was either used immediately at other points in the Canal Zone or stored for future use.

In addition to the maintenance work, the division also had charge of considerable construction work in this district, including the building of the silver town site of La Boca; constructing the water and sewer systems and streets in Pedro Miguel and the concrete storm sewers in the gold town site of Balboa; the construction of the driveway in front of the Tivoli Hotel; the widening of the road leading to the hotel from Panama City; the installation of a water and sewer system for the Darien radio station; the installation of a permanent water-supply system for the Balboa shops; also the completion of the Ancon-Diablo macadam road, which was commenced in the previous year; and the supervision of the work on the Empire-Gamboa macadam road, which is being built by the Canal Zone government with prison labor. This is in addition to the construction work performed during the year in the city of Panama, which is referred to below.

The different pump stations in the southern district were operated successfully during the year, the following table giving a result of the operations for each:

Pump station.	Gallons water pumped, daily average.	Period.
		<i>Months.</i>
Ancon.....	631,100	12
Cocoli.....	5,341,230	3
Miraflores (temporary).....	5,396,730	9
Pedro Miguel (temporary).....	5,404,400	3½
Cucaracha.....	464,500	12
Comacho.....	707,200	12
Gamboa.....	1,372,800	8
Caimito.....	5,238	7

The usual maintenance work was performed on the reservoirs in the district. The following statement gives the outflow of water from two reservoirs, with the elevation of the surface of the water on the last day of each month during the year:

Month.	Comacho.		Rio Grande.	
	Outflow.	Elevation.	Outflow.	Elevation.
1913.	<i>Gallons.</i>	<i>Feet.</i>	<i>Gallons.</i>	<i>Feet.</i>
July.....	32,282,000	348.2	119,842,000	210.9
August.....	26,177,000	350.2	77,476,000	212.24
September.....	24,847,000	348.6	51,440,000	220.04
October.....	44,262,000	349.9	73,784,000	222.73
November.....	40,829,000	358.5	93,300,000	232.27
December.....	54,942,000	355.3	96,564,000	229.38
1914.				
January.....	34,990,000	351.7	64,844,000	225.70
February.....	33,845,500	347.9	62,415,000	221.47
March.....	35,510,000	343.3	27,336,000	218.93
April.....	28,240,000	338.5	24,314,000	215.77
May.....	22,555,000	341.8	24,610,000	218.44
June.....	18,772,000	349.2	24,422,000	229.09

Upon requests of the district inspectors of the health department a great deal of work was done each month by this division on maintenance of sanitary ditches and other similar work. A total of approximately 425 miles were cleaned during the year.

The work in the city of Panama included the usual maintenance work on the water and sewer system and the necessary repairs to the pavement; also the inspection and testing of plumbing installations, and the preparation and collection of water-rent bills. The number of metered connections in use in the city of Panama on June 30, 1914, was 2,223, with 48 applications pending, an increase of 133 over the number of metered connections in use at the beginning of the year.

The amount of water rentals collected during the year was \$134,820.10, all of which was used in payment of interest on and reduction of the capital cost after the regular quarterly charges for maintenance and operation had been paid. In addition to these water-rental collections, a deficiency bill was rendered against the Panama Government for the quarter ending March 31, 1914, amounting to \$15,569.01.

At a conference between officials of the Panama Government and of the Isthmian Canal Commission, held on June 7, 1913, an agreement was reached whereby certain sanitary improvements in the city of Panama were to be made by the Isthmian Canal Commission and the cost of same paid from a special appropriation of \$76,000 by the Republic of Panama. The following list of improvements in the city of Panama were made by the division of municipal engineering during the past year under authority of this appropriation:

Project No. 2.—The improvement of Calle Neveria, including the macadamizing of the street from the end of existing improvement to the intersection of street passing by the municipal stables, together with the construction of concrete curb and gutter and the placing of water and sewer mains in the street. Cost of the work, \$4,536.96.

Project No. 4.—The construction of a concrete storm sewer from B Street down West Eighteenth Street to the beach, and the construction of a similar sewer of smaller section from West Nineteenth Street down B Street to connect with the one leading to the beach. Cost of the work, \$31,503.29.

Project No. 5.—The extension of the water and sewer mains and the placing of concrete curb and gutter on the Sabanas Road from a point where the sewer formerly ended opposite the orphan asylum to the junction of the Sabanas and Corozal Roads. Cost of work, \$5,429.30.

Project No. 6.—Macadamizing and constructing of concrete curb and gutter in Santa Rosa Street from the Zone Line Road to Ancon Boulevard. Cost of work, \$956.06.

Project No. 7.—Macadamizing and the placing of water and sewer mains in the street past the municipal stables leading from Calle Neveria to the Sabanas Road. Cost of work, \$2,723.86.

Project No. 8.—Construction of extensive improvements around and in front of the National Institute in Panama City, including the macadamizing of the street directly in front of it and the construction of concrete sidewalks and steps. Work was still in progress at the close of the fiscal year. Cost of work to April 30, \$13,044.16.

Improvements were made by certain private individuals in that part of the city of Panama known as the Chorrillo district, and at the

conference referred to it was agreed that the promoters who had had charge of these improvements should be reimbursed out of this special appropriation not to exceed \$20,000 upon completion of their work and recommendation from this division that the maintenance of the improvements in the district be assumed by the Government. The work in the district was inspected by representatives of the division during the time it was in progress, and upon final completion the streets and water system and sewers in the district became a part of the improved area of the city of Panama.

Several other improvements were made in the city of Panama during the past year by the division at the expense of the Panama Government that were not included in the projects discussed at the conference of June 7, 1913. The principal ones were the construction of curb and gutter along the Zone Line Road south from the National Institute; the macadamizing and placing of water and sewer mains in Calle de la Independencia from Seventeenth to Nineteenth Streets; the concreting of a portion of East Seventeenth Street at its junction with Central Avenue; the paving of East Twenty-third Street with brick; the extension of E Street for a distance of 324 feet from West Sixteenth Street; cutting off the corners at the junction of I Street and Central Avenue and the widening of the street at this intersection; the installation of a 6-inch trunk sewer and a 4-inch water line and the construction of concrete curb and gutter in the street near the new bull ring on the Sabanas Road; the installation of a sewer main from East Twenty-third Street across the Panama Railroad yards to East Nineteenth Street, Guachapali; and the concreting of B Street from Eighteenth Street west to the Zone boundary line. The cost of this last item and also the paving of East Twenty-third Street was borne jointly by the Panama Government and the Panama Tramways Co. The concreting of B Street was undertaken in May and was still in progress at the close of the fiscal year.

Authority has been given to lay an additional 10-inch main from a point in Ancon to connect with the Panama system in the vicinity of the orphans' asylum on the Sabanas Road. Work on the installation was in progress at the close of the year.

WATERWORKS FOR SOUTHERN END OF CANAL.

In March, 1913, the question of providing a permanent, adequate, and suitable water supply for the towns in the Canal Zone from Pedro Miguel south, including the city of Panama, was first taken up. The completion of the Miraflores Locks and the flooding of the Miraflores Lake would of necessity result in the elimination of the Cocoli pump station, located on the west side of the canal, from which station a large percentage of the total water consumed south of Pedro Miguel was being furnished. It was decided that this, combined with the fact that the Rio Grande watershed could no longer be considered available for more than possibly 3,000,000 gallons of water per day, and with the fact that, while the arrangement of pipe lines, pumping stations, and the pressure filter plant at Ancon had successfully met up to this time all demands placed upon them, the concentration of headquarters of all departments in the Balboa district, the constant growth and expansion of the city of Panama, and

the development of terminal facilities and shops at the entrance to the canal, called for the development of an entirely new source of supply and the design and construction of modern purification works and pumping stations, all to form a necessary part of the complete canal equipment.

The results of the first studies of the project as a whole were embodied in the report of a committee submitted March 12, 1913. This report as approved recommended the construction of the necessary pumping stations; the laying of the necessary additional main water lines; construction of a complete purification plant of the rapid, mechanical, gravity type; and the construction of a high-service reservoir on the side of Ancon Hill; all to be based on a nominal maximum capacity of 12,000,000 gallons of filtered water per day.

Further detailed studies resulted in the presentation of a report on design and estimates of cost on five different projects. One of these involved taking the raw water from Miraflores Lake, pumping it to the water purification plant, to be located on Miraflores Hill immediately above the spillway; laying a new 30-inch main from this plant to the Ancon district; the construction of a booster pumping station at Ancon; and the enlargement of the then existing 1,000,000-gallon reservoir on the side of Ancon Hill to a reservoir of 2,500,000-gallons' capacity. This involved locating the raw-water pump station on the Camitillo arm of the Miraflores Lake east of the Panama Railroad.

This project, making use of the Miraflores Lake water, figured out to be by far the cheapest and most suitable of any project contemplated or considered feasible, but it involved the condition that the water of Miraflores Lake should not increase in chlorine content beyond 75 to 100 parts per million through the operation of the Miraflores Locks admitting sea water to the lake. A discussion of the possibility of such a rise of chlorine developed the opinion that the chance would be good for the upper layers of the remote arms of the lake not rising in chlorine beyond a usable limit, at least for a period of years, assuming that intimate diffusion between the salt water admitted by the locks and the fresh water of the lake would not be rapid. It was thought that at the end of dry seasons, if necessity arose, the salt or heavier water might be drawn off from the lake and the surface raised back to normal level by admission of fresh water from the Gatun Lake. With this question temporarily settled in this way, authority was given to proceed and work was commenced August 1 of the fiscal year. The impending filling of the Miraflores Lake necessitated the construction of the foundations and sumps of the raw-water pump station and the intake and screen chambers, which part of the work was completed in November at the time the Miraflores Lake had commenced to fill. Following this the walls of the pump station were carried up to the level of the roof and work was suspended at this point the latter part of December.

The water-purification plant is to be similar in general features of design to the new purification plant located at Mount Hope. It consists principally of an aeration basin in which the raw water is first admitted and thrown up in the air into spray as a preliminary treatment; a head house, containing mixing chambers, where dif-

ferent chemicals are applied, aluminum sulphate and hypochlorite of lime solution mixing tanks and storage rooms for these chemicals; a sedimentation basin, approximately 125 feet wide by 300 feet long, 16 feet deep, holding approximately 4,500,000 gallons, giving at 12,000,000 gallons output per day, approximately 8 hours sedimentation; a filter building, approximately 62 by 150 feet in length, containing 14 filters, arranged 7 on each side of a central gallery and supported on columns over a clear water basin, having a capacity of approximately 900,000 gallons of water; an office, laboratory, and quarters building; a wash-water pump station, known as station No. 2, containing pumps for pumping filtered water up to a wash-water tank of 300,000 gallons capacity; and an injection chamber and control house, in which is measured and applied the hypochlorite of lime to be used as a sterilizing agent as a final treatment after filtration. (See plates Nos. 96 and 97.)

The three pumping stations are to be equipped with single or multi-stage centrifugal pumps, direct connected on the same bed plates to induction motors operating on a 220-volt, 25-cycle, 3-phase current. All piping will be placed in the basement below the main floors and all valves will be hydraulically operated from central slate operating tables.

In the case of the Ancon pump station there will be contained within the building a high-service and low-service system so designed that in the event of fire in Panama city or other points east of the station the operation of three hydraulic valves would place the high service in the mains for fire use without disturbing service in the mains to the west of the building, or, in case of fire in the terminals in the Balboa district, requiring the use of the high-service system, similar valve control would make available the high-service system in this district without affecting the low-service system in the Panama district. In the same way arrangements have been made to provide a high-service supply back to the town of Corozal for use in case of fire.

Work was commenced on the purification plant, located on Miraflores Hill, on August 1, and steam-shovel and hand excavation was completed by January 28. The concrete work was immediately commenced, and at the end of the fiscal year the clear-water basin; the main and false floors of the 14 filters, including the strainer system; the floor and underdrain system of the sedimentation basin; 25 per cent of the walls of this basin; and the main mixing chambers of the head house were practically completed. (See plate No. 19.) In addition, the new 30-inch line between the purification plant and Ancon was received from the States, laid, and placed in service on the existing raw water supply. The construction of the high-service reservoir, located at elevation 300 on the side of Ancon Hill above the old administration building, was commenced September 1 and completed and placed in service on June 1, 1914.

The construction of the Ancon pumping station, known as pumping station No. 3, was commenced in January, and at the end of the fiscal year was practically completed and ready for installation of pumping equipment. The electrical pumps for this station were rejected at the works of the contractor, following preliminary tests, because of failure to meet efficiency requirements. The delays inci-

dent thereto will result in delivery not being made until approximately October 1, or five months after contract date.

In January chlorine sampling stations were established in Miraflores Lake and weekly samples were taken of the water at the bottom and at the surface. These stations, numbered 1 to 5, were located as shown on the accompanying chlorine chart, plate No. 98. It was early discovered following the commencement of the operation of the locks that the chlorine content was steadily rising. By February this content had risen to a point where it seemed that constant diffusion was taking place and throughout all areas of the lake was general. The chlorine content of the surface of the water in the Caimitillo arm of the lake had by this time risen to approximately 60 parts per million, and the first trouble was experienced with boilers at the Miraflores power plant.

In connection with the observations for chlorine at the different stations referred to, a strikingly high and unaccountable amount of chlorine was found immediately south of the end of the south center approach wall of the Pedro Miguel Locks. In this vicinity, for a width of approximately 200 feet and for a length to the south of approximately 2,000 feet, the bottom samples of water showed chlorine contents running at times as high as 15 per cent salt water, or 3,000 parts per million.

In order to bring down the chlorine content of the water being pumped to Panama, a temporary pump station was installed at Pedro Miguel and approximately 4,000 gallons of water per minute was pumped from the cut north of the Pedro Miguel Locks and discharged into the Miraflores Lake immediately in front of the temporary pump station. This resulted in a decided drop of the chlorine content of the water going to Panama, but resulted in a great increase in the turbidity of the water due to turbid conditions of the water in Culebra Cut. The operation of this pumping station was continued in an effort to keep down the chlorine or to vary it at will until the beginning of the rainy season when the influx of fresh water from the watershed lowered the chlorine from 100 parts per million to approximately 55 parts, where it stands at the present time. (See chlorine chart, plate 98.) On June 1 the temporary pump station at Pedro Miguel was closed down.

By the middle of February the general rise of chlorine had become such as to indicate that Miraflores Lake would eventually reach a degree of salinity that would make it impracticable for use as a source of industrial and domestic water supply for the southern end of the canal. Recommendations were made at this time in connection with the presentation of several reports on the matter that the lake be abandoned as a water supply; that the raw water pump station be moved to the Chagres River arm of the Gatun Lake at Gamboa; and that the raw water be taken from the Gatun Lake at this point and pumped through a 30 to 36-inch cast-iron main laid alongside the main line of the Panama railroad to the purification plant on Miraflores Hill. Under this project it would be necessary to pump the water to the summit of the continental divide. From this point it would run by gravity to the aeration basin at Miraflores; thence through the purification plant by gravity, and from there by gravity to pump station No. 3 at Ancon, where it would be

pumped into the service mains and into the high and low service reservoirs.

Pending action on this recommendation various studies of the flow of the salt water from the locks into the lake were made. In an effort to draw off the heavy saline water lying at the bottom of the lake the surface was drawn down to approximately elevation 40 feet above sea level, and the lake was refilled with fresh water from Culebra Cut. This operation tended to distribute and diffuse the water of high chlorine content within the vicinity of the Pedro Miguel Locks, with the result that the general chlorine content of the lake was found to be higher after the operation than before. Further, the chlorine was found to have extended up the Caimitillo, Pedro Miguel, and Cocoli River arms of the lake, thereby indicating more or less conclusively that the presence of any water carrying a higher chlorine content than the normal fresh water was accompanied by constant diffusion and tendency of the general chlorine content of the lake to rise.

On May 11 decision was finally made to adopt Gatun Lake at Gamboa as a source of permanent water supply and work was commenced immediately to this end. By the end of the fiscal year the excavation for the sump for the raw-water pump station at this point had been practically completed and the specification and plans for the cast-iron pipe line from this plant to Miraflores accompanied by specifications was ready for bidders.

OPERATION OF PURIFICATION PLANTS.

The operation of water-purification plants in the Canal Zone was in charge of the physiologist of this division.

At the Agua Clara plant the wash-water tank, having a capacity of approximately 10,000 gallons, referred to as under construction in the last annual report, was completed and placed in service. This resulted in more satisfactory wash conditions in connection with the operation of the filters, increasing the rate of wash water from approximately four to nine gallons per square foot of area of filtering surface.

The completion of the construction work at Gatun resulted during the year in a marked drop in the consumption of water, which in turn resulted in the operation of the filters at less than one-half their rated capacity. With the view to keeping all the filters in the plant in service, the rate controllers were changed so as to give a filtration rate of approximately 65,000,000 gallons per acre per day. This gave satisfactory results for the first part of the year, but resulted during the last three months in the development to a more or less extent of growths in the underdrains, which has resulted in an increase of the bacterial count in the filtered water.

The new purification plant at Mount Hope is similar in practically all respects to plants of like character constructed in the United States, with the addition of an aeration basin containing more or less elaborate nozzles for breaking the water into fine spray as preparatory treatment to sedimentation. In the design of the aeration nozzles arrangements were made whereby the nozzles automatically open or close depending upon the flow through the filters, and thus is automatically controlled the input of raw water to the plant. This

device, which it is believed has not been embodied in plants of this character heretofore, has given excellent service during the first three months of operation.

The aeration system, in addition to assisting in removal of odors and taste, also decreases the iron content of the water by oxidizing and precipitating that portion which exists as ferrous oxide or hydroxide. However, to date, this portion of the iron content has been almost negligible, and most of the iron has been found existing as iron organic compounds, so that straight coagulation and sedimentation has been sufficient to remove it. During aeration the free carbonic acid is almost completely removed and the dissolved oxygen content increases practically to the saturation point.

The sedimentation basins have been operated on a more or less experimental basis in order to determine the period of sedimentation that would give best results from all standpoints. With one basin in use under the present output from the plant approximately five hours sedimentation is obtained, and two basins in service gives double this period. It has been indicated by the condition of the water for the past three months that a longer period of sedimentation results in longer filter runs and requires a less amount of wash water for cleaning. On the other hand, however, the longer period seems to favor bacterial growths both in the basins and the filters, resulting in a lower relative efficiency based on apparent bacteria removal. With the shorter period of sedimentation, the bacteria removal has been quite satisfactory and the tendency toward bacterial growth seems to be lessened. The high temperature of the water averaging 29° C., flowing into the sedimentation basin gives rise to excessively heavy floc, necessitating weekly cleaning of the basins. The amount of sludge produced in a week's time is remarkable, and although the organic content of the raw water is comparatively high this great amount of sludge is one of the striking characteristics of the plant.

The average results obtained from the old pressure filter plant at Ancon and at Mount Hope and from the gravity filter plant at Agua Clara for the past year are shown by the following table:

	Mount Hope.	Agua Clara.	Ancon.
Gallons water filtered, monthly average.....	89,846,000	45,332,000	77,009,000
Gallons water filtered, daily average.....	2,994,854	1,511,079	2,566,980
Bacteria in raw water per c. c.....	737	511	624
Bacteria in filtered water per c. c.....	367	182	455
Alum used, pounds, average per month.....	29,040	13,920	19,620
Alum used, pounds, average per day.....	963	464	654
Alum used per gallon, grains.....	2.1	2.1	1.7

The average results of the operation of the new Mount Hope plant for the last three months of the year are given below:

Gallons treated.....	123,239,000
Wash water, gallons.....	11,883,000
Per cent wash water.....	9.9
Filters washed.....	278
Average minutes wash water.....	7.8
Alum, grains, per gallon.....	2.23
Average filter, hours per day.....	82.5
Average number filters, service.....	3.4
Average length run between washing, hours.....	9.3

The following table gives the average result of analyses of raw and filtered water at the new Mount Hope purification plant for the last three months of the year, and of the Agua Clara filter plant for the last six months of the year:

	Mount Hope.		Agua Clara.	
	Raw.	Filtered.	Raw.	Filtered.
Turbidity	25	.....	25	.....
Color	50	9	85	2
Alkalinity	34	29.8	23	6
Chlorine	6.7	6.3	6.4	6.4
Oxygen consumed	4.6	1.8	5.2	1.8
Nitrates	Trace.	.....	Trace.	Trace.
Iron	1.0	.3	1.2	Trace.
Free CO ₂	3.7	6.9	5.1	10.1
Total solids	98	69	95	80
Loss on ignition	31	20	54	12
Number times B. coli present in month in—				
10 c. c.	16	3	15	1
1 c. c.	8	.....	4	.....

The Miraflores Lake water is polluted to a more or less extent by the sewage from the towns of Pedro Miguel and Paraiso and the floating equipment operating through the canal. The use of this water as a domestic and industrial supply for the southern end of the canal makes imperative its treatment with hypochlorite of lime.

The necessary solution tanks, control apparatus, and measuring orifices were designed and constructed as a part of the temporary pumping station at Miraflores, and hypochlorite bleach was introduced into the water on the suction side of the pumps at the time this station was first placed in service in the month of October.

The turbid conditions obtaining demanded the use of comparatively high quantities of bleach per million gallons of water. At times this quantity reached 30 pounds of chemical per million gallons of water, giving approximately 1.2 parts per million available chlorine without objectionable tastes or odors being complained of by the consumers. The comparatively high temperature of the water, combined with high organic and low mineral content, no doubt explains this. On an average 0.7 to 0.8 parts per million of available chlorine has been giving satisfactory bacteriological results.

DESIGNS.

The work accomplished in the drafting room of the division office covered the complete studies and designs of the entire water-supply project for the southern end of the canal. This involved the making of approximately 300 large tracings of general and detail plans of buildings, equipment, and control apparatus entering into the construction of the purification plant and pumping stations. At the end of the fiscal year all of the principal drawings had been completed, and there remains at this date the studies and designs of numerous small control apparatus to be installed in connection with the application of the chemicals at the Miraflores purification plant. There also remains to be designed certain laboratory equipment and details of small devices to be embodied therein.

In addition to the above, there were completed 10 detail drawings required in connection with the construction of the new town sites of Pedro Miguel and La Boca, and miscellaneous improvements accomplished during the year in the cities of Colon and Panama for the Government of Panama. Plans for the permanent water supply at Toro Point were prepared.

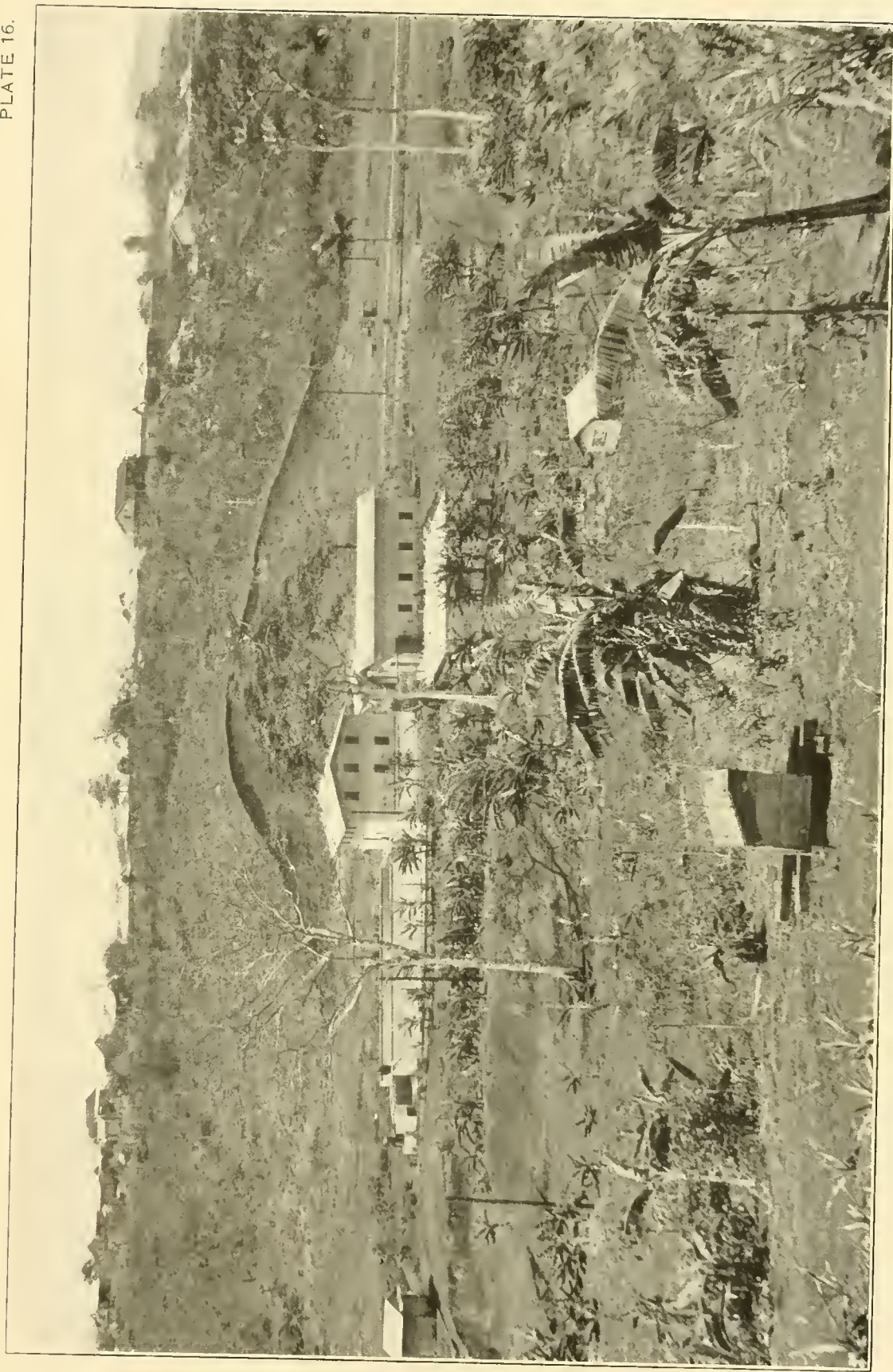
Approximately 7,000 blue prints were made and issued during the year.

Plate No. 139, a chart showing the organization of the division as of June 30, 1914, is appended hereto.

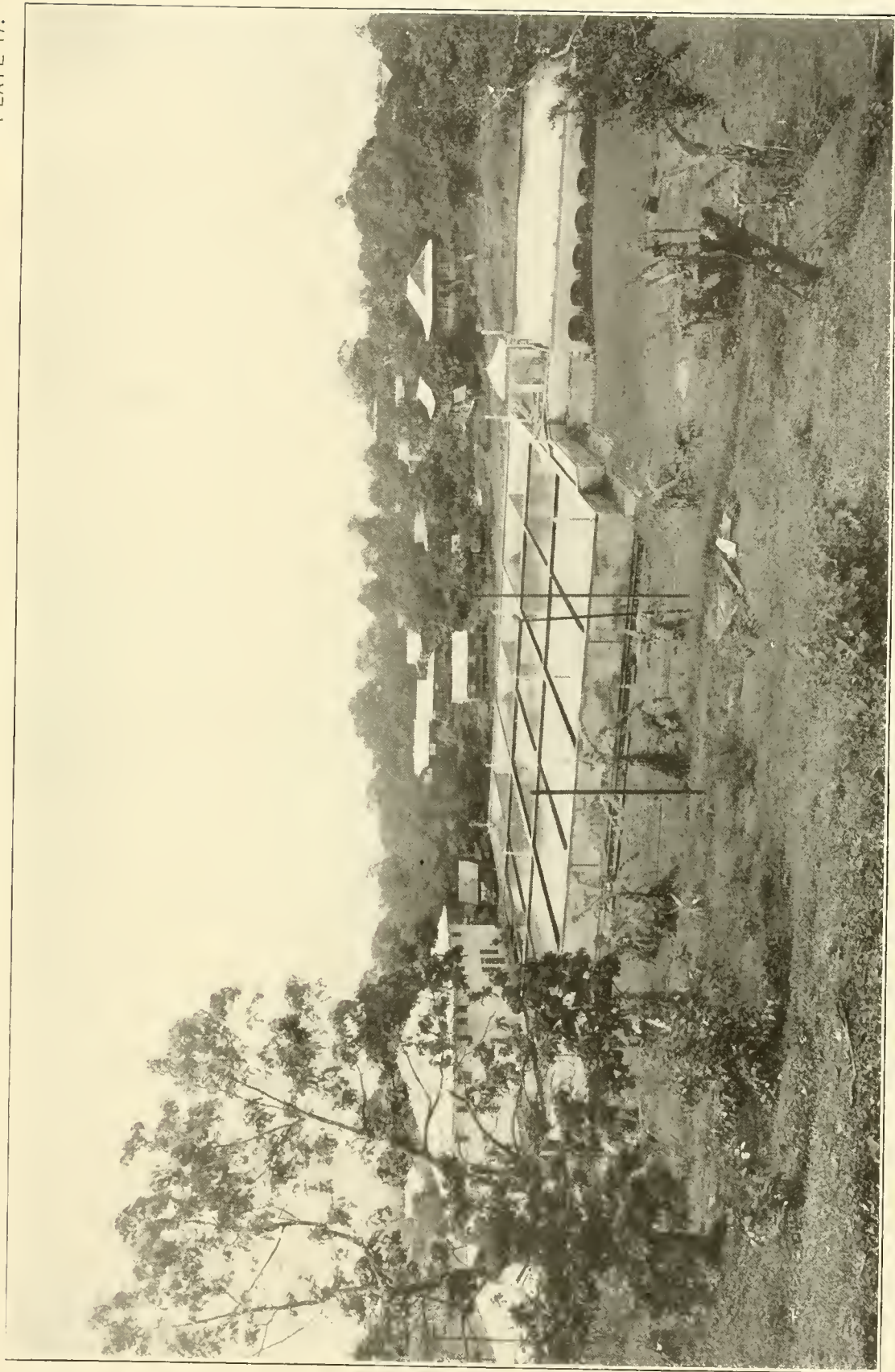
Respectfully submitted.

GEO. M. WELLS,
Resident Engineer.

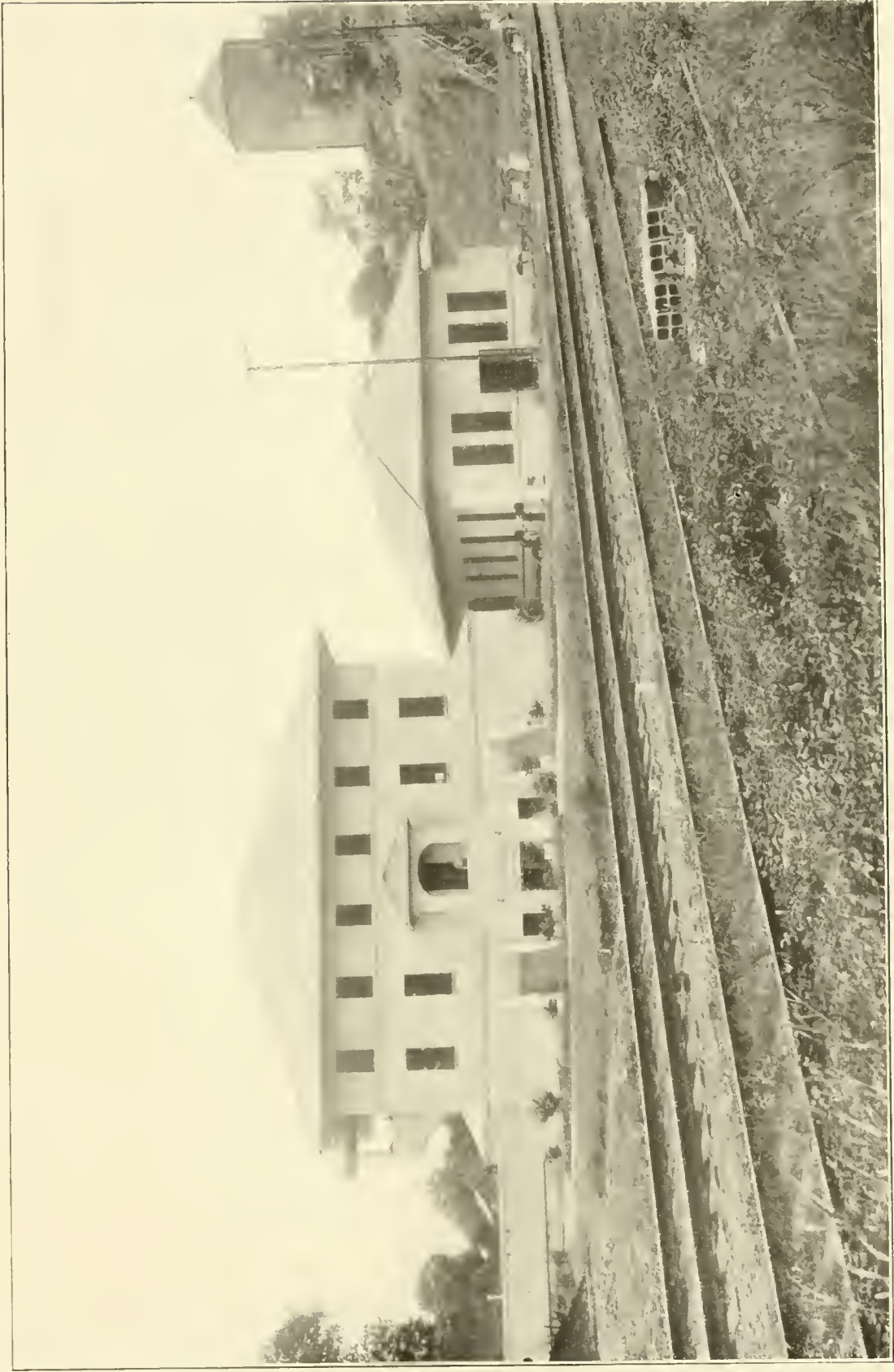
Col. H. F. HODGES,
Engineer of Maintenance, Culebra, Canal Zone.



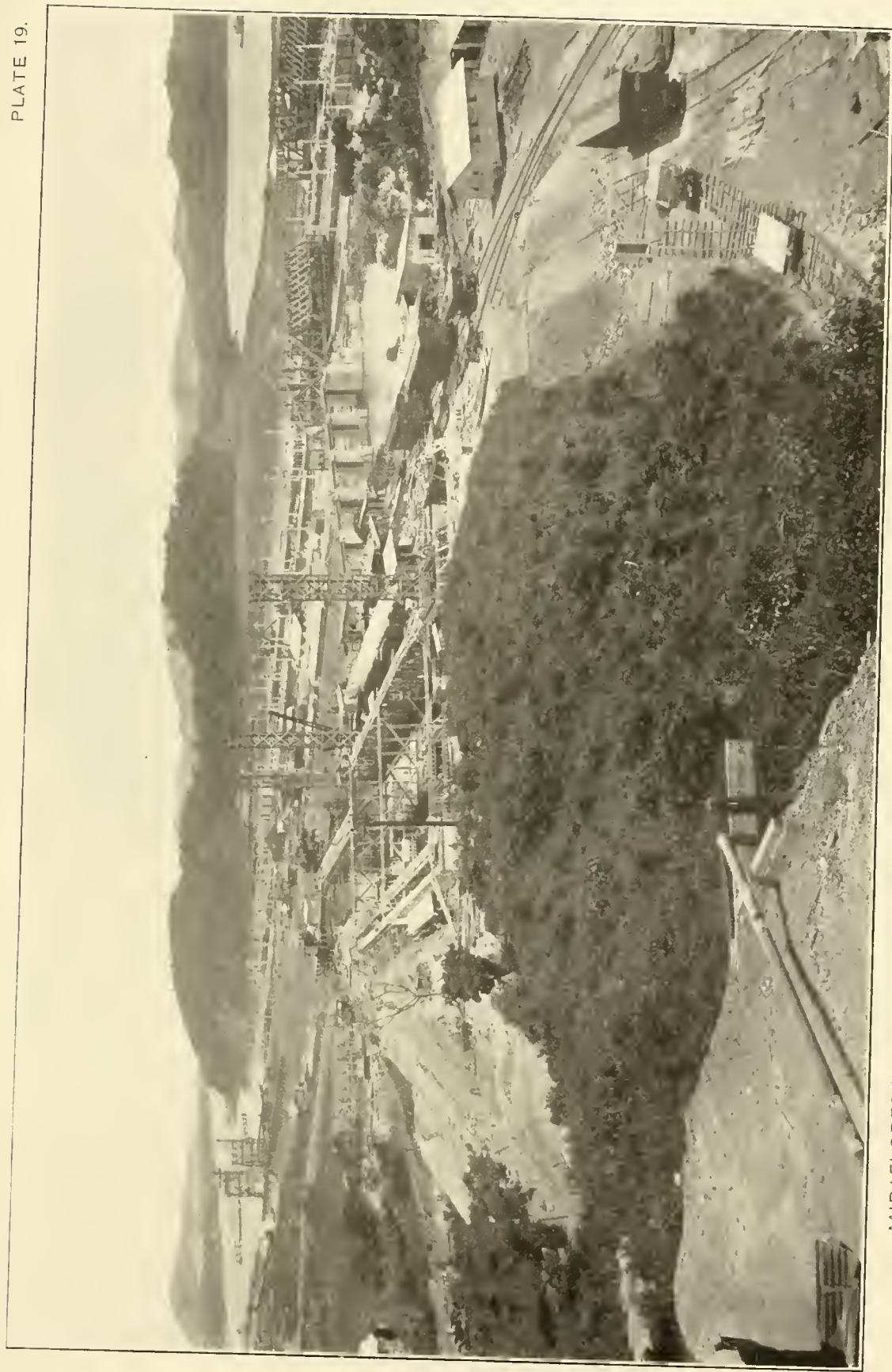
AGUA CLARA PURIFICATION PLANT. GENERAL VIEW LOOKING SOUTH. APRIL 4, 1913.



MOUNT HOPE WATERWORKS AND PURIFICATION PLANT, SHOWING SEDIMENTATION BASIN, AERATION BASIN, AND
FILTER BUILDING.



MOUNT HOPE WATERWORKS AND PURIFICATION PLANT. FILTER BUILDING AND PUMP STATION, FRONT VIEW.



MIRAFLORES WATER-PURIFICATION PLANT. WASH-WATER TANK. LOOKING SOUTH. MAY 30, 1914.

APPENDIX A-3.

REPORT OF CHIEF HYDROGRAPHER, SECTION OF METEOROLOGY AND HYDROGRAPHY.

CULEBRA, CANAL ZONE, *July 10, 1914.*

SIR: I have the honor to submit herewith the report of the section of meteorology and hydrography for the fiscal year 1913-14:

PERSONNEL.

The personnel of the division remained the same as that of last year until the reorganization was effected April 1, 1914, consolidating the meteorological and hydrographic sections into one division under a chief hydrographer, reporting to the engineer of maintenance. This reorganization effected a reduction of three in the gold force, two hydrographers, and one observer, and regraded the supervisor as chief hydrographer and the principal meteorologist as assistant chief hydrographer.

The present force consists of Chief Hydrographer F. D. Willson, Assistant Chief Hydrographer H. G. Cornthwaite, and five assistants.

During the year, in addition to the regular duties, much special work was performed for other divisions and outside scientific bodies of the United States and foreign Governments.

METEOROLOGY.

General.—Few changes were made during the past fiscal year in the meteorological stations operated under the direction of the chief hydrographer. Except as noted below, all of the stations enumerated in the annual report of the Commission for the fiscal year 1913 were continued in operation.

Sosa wind records were discontinued on January 1, 1914, and the station dismantled.

The wind station at Gatun was moved from Guarapo Island to its present location on the administration building at Gatun December 16, 1913. The wind station at Pedro Miguel was removed from the west side of the canal to its present location on the tower of the hydrographic station on the upper east wing wall of the locks November 14, 1913.

A wind station was established at Gamboa on November 11, 1913. The instruments are exposed on the tower of the hydrographic station.

Evaporation records at Brazos Brook were discontinued on April 1, 1914.

The seismograph station on Guarapo Island was closed on February 20, 1914, and the instruments returned to their original location at Ancon. These instruments were installed on Guarapo Island for the purpose of recording any possible tilting or subsidence of earth strata due to the building of Gatun Dam or the filling of the lake. The records showed no evidence of tilting or depression, and the instruments were removed soon after the lake filled to operating level.

A lake rainfall station was established on the Siri branch of the Trinidad in January, 1914, and a similar station was established near the head of the Gatun River branch of Gatun Lake in May, 1914. Records from these stations are obtained for use in estimating the monthly rainfall over the lake watershed.

Instruments for recording wind velocity and direction were installed at the site of the Darien radio station on June 18, 1914. This installation was made at the request of the engineer in charge of terminal construction.

Precipitation.—The rainfall for the year 1913 was deficient at all stations except Brazos Brook, Colon, and Porto Bello. The annual totals ranged from 59.54 inches at Balboa to 171.19 inches at Porto Bello. The average precipitation in the Pacific section was 65.96 inches, and in the central and Atlantic sections 84.93 inches and 138.50 inches, respectively.

The 1913 dry-season rainfall amounted to but 4 per cent of the annual total in the Pacific section, 8 per cent in the central section, and 10 per cent in the Atlantic section. May was the rainiest month in all sections and March the month of least rainfall.

The maximum 24-hour rainfall recorded during the year 1913 was 10.65 inches at Porto Bello on May 14–15. Daily quantities in excess of 4 inches were recorded as follows:

Station.	Date.	Amount.
		<i>Inches.</i>
Porto Bello.....	May 15	10.57
Do.....	May 16	5.90
Colon.....	May 21	4.74
Brazos Brook.....	Aug. 10	4.35
Porto Bello.....	do.....	6.06
Do.....	Aug. 15	4.04
Colon.....	Aug. 28	4.55
Monte Lirio.....	Oct. 20	4.00
Brazos Brook.....	do.....	5.50
Porto Bello.....	Nov. 8	5.13
Do.....	Nov. 24	4.44

Rainfall during the first six months of 1914 has continued generally below normal. The greater part of this deficiency occurred in the dry-season months—January to April, inclusive. Monthly records for 1913, 1914, and the station averages are represented in Table No. 1, while the maximum rainfall of record for periods of 5 minutes, 1 hour, and 24 hours at stations equipped with automatic registers is shown in Table No. 2.

Temperature.—The average air temperature for the year 1913 was slightly above normal. March was the month of highest mean temperature and November the month of lowest temperature.

The means and extremes in air temperature for the year 1913, at the three first-class stations, are presented in the following table:

Stations.	Maximum.		Minimum.		Annual mean.
	° F.	Date.	° F.	Date.	° F.
Ancon.....	96	Apr. 27	66	Feb. 22	80.3
Culebra.....	95	Apr. 14	64	Jan. 4	79.2
Colon.....	91	June 22	71	Feb. 4	80.1

The absolute maximum and minimum temperatures of record are shown below, revised to June 30, 1914:

Stations.	Maximum.		Minimum.	
	° F.	Date.	° F.	Date.
Ancon.....	97	Apr. 7, 1912	63	Jan. 27, 1910
Culebra.....	96	May 5, 1912	61	Mar. 21, 1910
Colon.....	92	June 3, 1909	66	Dec. 3, 1909

NOTE.—The lowest temperature of record on the Isthmus was 59° F., observed at Bas Obispo on Feb. 9, 1907. The maximum temperature record at Ancon, 97° F., was equaled at the Naos Island station on Feb. 13, 1906.

Temperatures continued generally above the station averages during the first six months of 1914.

Monthly temperature records and other weather data for the year 1913 at the three first-class stations are presented in Tables Nos. 3, 4, and 5.

Wind.—Wind records on Sosa Hill were continued throughout the year 1913 for comparison with the Ancon records. The average wind movement for the year was 47 per cent greater on Sosa Hill than at Ancon, due to the higher elevation and better exposure of the Sosa instruments. The prevailing direction was from the northwest at each station. Northwest wind prevailed 81 per cent of the time at Sosa and 60 per cent of the time at Ancon.

The wind movement over the Canal Zone for the year 1913 was generally slightly above normal. North and northwest winds prevailed. March was the windiest month at all stations and November the month of least wind movement.

The following table, revised to June 30, 1914, shows the maximum wind velocities of record at the first-class stations:

Maximum velocity.

Stations.	Miles per hour.	Direction.	Date.
Ancon.....	59	S.....	July 10, 1909
Culebra.....	40	NE.....	Nov. 19, 1913
Colon.....	40	S.....	July 16, 1908

Atmospheric pressure.—The mean pressure for the year 1913 was generally below normal. February was the month of highest mean pressure at all stations and November the month of lowest pressure.

Relative humidity.—The mean relative humidity in 1913 was practically normal at all stations. The lowest average humidity occurred in April and the highest in November.

Cloudiness.—The average daytime cloudiness was generally below normal during the year 1913. February was the month of least average cloudiness and May and November the months of heaviest cloudiness.

Evaporation.—The evaporation for 1913 was above the station averages at all stations, but it was generally lighter than the annual evaporation in 1912. Evaporation during the first six months of 1914 continued above normal. The monthly records are shown in Table No. 6. The annual evaporation in 1913 and station averages are presented in the following table:

Annual evaporation.

Station.	1913	Average.	Years of record.
Ancon.....	58.253	48.773	6
Rio Grande.....	54.950	53.609	5
Gatun.....	64.811	61.527	3
Brazos Brook.....	63.211	56.100	5
Colon.....	54.942	51.536	5

Fogs.—Night and early morning fogginess was of frequent occurrence during the year 1913. The average number of fogs observed at the interior stations was 137. The greatest number of these occurred during May and the least number in February. Few fogs were observed during the year at either coast station. Practically all fogs lifted or were dissipated by 8.30 a. m.

Sea temperature—The average surface temperature of the sea water for the year 1913 was approximately normal on both coasts. The highest temperature recorded was 87° F. at Colon on several dates, and the lowest 64° F. at Balboa in February and March.

Tidal conditions.—Tide registers were continued in operation at Balboa and Colon. The tidal extremes of record at these stations are given below (length of record, seven years), table revised to June 30, 1914:

Station.	Maximum high water.		Extreme low water.		Maximum daily range. ¹		Minimum daily range. ¹	
	Elevation.	Date.	Elevation.	Date.	Feet.	Date.	Feet.	Date.
Balboa.....	+11.2	Oct. 2, 1909	−10.6	Apr. 11, 1910	20.8	Apr. 11, 1910	5.1	Mar. 24, 1911
Colon.....	+ 1.65	Nov. 27, 1909	− 1.01	June 9, 1910	2.17	June 28, 1911	(2)	.....

¹ For consecutive tides.

² One tidal fluctuation often entirely absent at Colon.

Tide conditions on the Atlantic and Pacific coasts for the year 1913 are shown in Table No. 7.

Seismology.—Seismic disturbances were more numerous and more severe on the Isthmus during the fiscal year 1913–14 than in any

previous year since the American occupation of the Canal Zone. Eighty-seven shocks were recorded at Ancon during the past fiscal year. Of these 55 were of comparatively local origin—less than 200 miles distant. The remainder were tremors from shocks of distant origin.

Practically all of the local shocks seemed to originate in the vicinity of the lower coast of Los Santos Province, approximately 115 miles southwest of Ancon. Ten of these shocks were of sufficient intensity to be generally felt over the Isthmus, ranging from intensity III to intensity V, Rossi-Forrel scale. The canal works suffered practically no damage from these shocks, although the new administration building at Balboa was slightly damaged by the shock of May 28.

A complete list of seismic disturbances recorded at Ancon during the fiscal year 1913-14 is presented in Table No. 8.

The following diagrams and tables accompany the meteorological section of this report:

Plate No. 99. Wind Roses, year 1913, dry and rainy seasons.

Table 1. Monthly rainfall on Isthmus of Panama.

2. Maximum rainfall in Canal Zone.

3. Monthly meteorological data, Ancon, year 1913.

4. Monthly meteorological data, Culebra, year 1913.

5. Monthly meteorological data, Colon, year 1913.

6. Monthly evaporation, Canal Zone, 1913-14, and averages.

7. Tidal conditions, year 1913.

8. Seismograph records, Ancon, fiscal year 1913-14.

TABLE 1.—*Monthly rainfall on Isthmus of Panama, 1913-14, and station averages.*

[Values in inches.]

Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Ancon:													
1913.....	0.63	0.22	0.43	0.03	8.27	8.15	4.85	8.20	11.43	8.30	10.63	4.84	65.98
1914.....	.32	.02	T.	4.80	6.98	7.28	.....	.....	.....	.....	.....	.....	.....
Average, 16 years.	.99	.81	.76	2.58	8.93	8.15	7.97	7.57	7.69	10.77	10.46	4.22	70.90
Balboa:													
1913.....	.78	.19	0	.06	8.04	7.15	4.22	6.74	9.01	10.33	9.30	3.72	59.54
1914.....	.30	0	0	4.94	8.16	7.25	.....	.....	.....	.....	.....	.....	.....
Average, 15 years.	1.09	.54	.78	3.82	7.27	7.90	9.50	7.50	6.94	9.60	9.10	5.82	69.86
Miraflores:													
1913.....	2.65	2.49	0	.79	12.33	9.49	5.41	4.23	8.92	10.28	9.15	4.38	70.12
1914.....	.57	0	0	2.69	10.96	5.64	.....	.....	.....	.....	.....	.....	.....
Average, 5 years..	2.14	1.82	.72	3.18	9.85	10.56	8.44	8.21	10.62	12.54	11.72	7.53	87.33
Pedro Miguel:													
1913.....	1.10	.07	0	1.04	13.48	9.00	6.80	5.46	8.32	12.07	10.17	2.14	69.65
1914.....	1.27	.07	.02	3.00	13.16	11.35	.....	.....	.....	.....	.....	.....	.....
Average, 6 years..	1.01	.91	.37	3.19	11.07	10.09	8.73	8.31	8.81	12.46	10.86	6.51	82.32
Rio Grande:													
1913.....	2.09	.43	.30	1.12	12.33	8.05	5.74	7.68	8.95	7.08	9.15	1.59	64.51
1914.....	1.08	.25	T.	.83	10.77	9.92	.....	.....	.....	.....	.....	.....	.....
Average, 9 years..	1.43	.65	.32	3.26	11.07	9.20	10.45	10.04	10.93	12.43	10.90	5.45	86.13
Culebra:													
1913.....	1.57	.78	.57	.71	11.74	9.10	5.52	9.76	10.55	6.08	11.21	1.50	69.09
1914.....	.38	.20	.01	.62	13.26	8.06	.....	.....	.....	.....	.....	.....	.....
Average, 23 years.	1.74	.57	.68	3.67	11.18	8.87	9.34	10.54	11.20	11.32	12.26	7.41	88.78
Camacho:													
1913.....	1.60	.44	0	2.52	16.03	9.65	4.01	10.13	6.75	7.78	12.90	1.98	73.79
1914.....	.46	.33	0	.49	14.15	10.46	.....	.....	.....	.....	.....	.....	.....
Average, 7 years..	1.25	.76	.50	3.38	12.04	10.05	9.89	10.39	10.56	13.34	13.24	6.06	91.46
Empire:													
1913.....	1.67	.79	.22	.90	11.74	11.48	4.87	10.46	9.14	7.25	14.23	2.03	74.78
1914.....	.34	.27	T.	.50	12.87	8.87	.....	.....	.....	.....	.....	.....	.....
Average, 9 years..	.85	.58	.41	3.26	9.87	8.59	8.83	9.79	8.39	13.29	11.35	5.22	80.43
Gamboa:													
1913.....	2.65	.68	.08	1.07	15.13	8.02	8.06	16.45	9.48	8.71	14.13	1.82	86.28
1914.....	.64	.23	.02	1.38	10.28	17.78	.....	.....	.....	.....	.....	.....	.....
Average, 31 years.	1.87	.85	.81	3.46	11.05	9.64	10.37	12.33	10.47	12.67	12.32	6.81	92.65

TABLE 1.—*Monthly rainfall on Isthmus of Panama, 1913-14, and station averages—Continued.*

Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Juan Mina:													
1913.....	1.01	0.94	0.36	0.54	13.20	9.67	6.99	10.34	8.22	7.90	16.34	1.62	77.13
1914.....	.44	.38	.02	1.01	8.40	12.51	.....	.....	.....	.....	.....	.....	.....
Average, 3 years..	.40	1.08	.22	1.31	13.32	10.48	8.47	11.42	10.35	11.29	13.48	5.22	87.04
Alhajuela:													
1913.....	.96	.22	.08	.72	12.63	11.51	6.99	10.92	8.82	6.41	16.56	1.59	77.41
1914.....	.09	.22	.05	1.68	5.66	12.55	.....	.....	.....	.....	.....	.....	.....
Average, 14 years..	1.21	.75	.62	3.04	12.74	12.76	12.81	12.94	11.41	13.05	14.40	6.71	102.44
El Vigia:													
1913.....	.78	.86	.10	.98	13.35	10.80	6.32	10.24	7.50	8.26	16.91	1.03	77.13
1914.....	.28	.51	.14	2.05	7.47	17.34	.....	.....	.....	.....	.....	.....	.....
Average, 5 years..	1.13	2.39	.70	1.88	12.56	13.27	11.66	12.80	11.90	14.81	16.52	5.60	105.22
Frijoles:													
1913.....	3.85	3.03	.29	2.44	21.07	8.72	6.52	14.75	11.61	14.52	17.81	4.73	109.34
1914.....	.81	1.33	.40	2.95	14.33	13.05	.....	.....	.....	.....	.....	.....	.....
Average, 2 years..	2.26	3.02	.20	1.82	15.68	10.98	8.20	14.19	11.77	16.86	16.84	5.19	107.01
Trinidad:													
1913.....	3.45	1.80	1.11	2.52	17.73	11.20	8.36	13.39	11.30	11.86	10.43	4.12	97.27
1914.....	1.57	1.16	.71	3.16	13.58	9.61	.....	.....	.....	.....	.....	.....	.....
Average, 6 years..	3.34	2.68	2.82	4.75	14.69	11.10	9.32	11.63	12.05	14.62	20.00	10.03	117.03
Monte Lirio:													
1913.....	3.57	2.52	.60	3.54	16.29	10.71	8.70	10.42	14.12	14.90	15.02	7.19	107.58
1914.....	.83	1.55	1.19	4.44	11.42	14.55	.....	.....	.....	.....	.....	.....	.....
Average, 6 years..	3.60	4.04	3.23	4.65	14.67	13.13	13.23	11.02	12.44	16.32	22.89	10.53	129.75
Gatun:													
1913.....	4.63	2.92	1.01	5.38	17.06	10.70	9.73	12.32	9.95	15.17	15.88	8.06	112.81
1914.....	1.63	1.07	.96	3.26	10.91	12.64	.....	.....	.....	.....	.....	.....	.....
Average, 9 years..	3.92	2.46	2.70	4.20	15.82	13.39	12.08	14.09	9.73	16.45	21.67	12.79	129.30
Brazos Brook:													
1913.....	5.72	4.20	.71	5.23	18.77	12.17	11.51	16.93	11.96	17.85	21.32	12.52	138.89
1914.....	.90	.94	1.21	7.33	13.17	15.84	.....	.....	.....	.....	.....	.....	.....
Average, 7 years..	3.83	2.57	2.88	3.46	13.98	15.36	16.21	14.96	11.62	15.52	24.27	13.98	138.64
Colon:													
1913.....	6.71	1.75	.79	2.69	22.60	11.81	15.13	17.91	9.90	18.63	16.75	6.55	131.22
1914.....	1.35	1.32	.91	4.12	17.76	16.30	.....	.....	.....	.....	.....	.....	.....
Average, 43 years..	4.03	1.48	1.65	4.05	12.65	13.32	16.35	15.08	12.47	14.38	21.74	12.18	129.38
Porto Bello:													
1913.....	5.84	2.03	1.17	2.34	30.51	9.00	20.83	25.35	11.34	18.85	33.47	10.46	171.19
1914.....	2.38	2.20	.98	2.66	16.22	15.08	.....	.....	.....	.....	.....	.....	.....
Average, 6 years..	7.51	4.13	2.49	5.86	17.74	16.12	19.77	18.93	13.28	12.53	30.16	20.63	169.15

NOTE.—Station averages do not include records for the year 1914.

TABLE NO. 2.—*Maximum rainfall in Canal Zone October 1, 1905, to June 30, 1914.*

[Values in inches.]

Stations.	Maximum rainfall.					
	5 minutes.		1 hour.		24 hours. ¹	
	Inches.	Date.	Inches.	Date.	Inches.	Date.
Ancon (Oct. 1, 1905).....	0.64	Aug. 7, 1908	3.98	Oct. 9, 1911	7.23	May 12-13, 1912.
Balboa (June 10, 1906).....	.90	May 12, 1912	5.86	June 2, 1906	7.57	Nov. 16-17, 1906.
Pedro Miguel (Jan. 1, 1908).. ²	.60	Nov. 11, 1908	3.30	Aug. 27, 1908	4.56	Sept. 30-Oct. 1, 1909.
Rio Grande (Dec. 29, 1905).. ³	.75	July 24, 1908	3.10	Sept. 21, 1912	6.00	Dec. 2-3, 1906.
Culebra (July 1, 1906).....	.64	May 2, 1908	3.69	Oct. 16, 1907	5.55	Dec. 3, 1906. ²
Empire (July 18, 1906).....	.60	July 25, 1906	3.63	Oct. 1, 1909	6.15	Do. ²
Gamboa (Nov. 18, 1905).....	.59	July 27, 1908	3.32	May 11, 1911	6.56	Dec. 2-3, 1906.
Alhajuela (Mar. 31, 1907)....	.60	July 20, 1909	3.40	Dec. 28, 1909	8.19	Do. ²
Gatun (Aug. 24, 1907).....	.62	Aug. 3, 1912	3.82	May 26, 1910	10.48	Dec. 3, 1906. ²
Colon (Oct. 1, 1905).....	.64	Aug. 25, 1909	4.90	Oct. 8, 1909	8.53	Dec. 2-3, 1906.
Porto Bello (May 1, 1908).... ²	2.48	Nov. 29, 1911	4.53	Nov. 29, 1911	10.86	Dec. 28-29, 1909.
Bohio (Oct. 1, 1905) ⁴	.67	June 16, 1909	4.51	Aug. 7, 1908	8.85	Aug. 7-8, 1908.

¹ Maximum fall in any 24 consecutive hours.² No automatic record on this date; total for 24 hours ending at noon.³ Approximate; automatic record indistinct, due to unusually excessive rate of fall.⁴ Station closed January, 1912.

NOTE.—Dates in parentheses opposite station names refer to installation of automatic register.

TABLE NO. 3.—*Monthly meteorological data—Ancon, Canal Zone, year 1913.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).								Mean wet thermometer.	Mean temperature dew point.	Mean relative humidity.
	Station. ¹	Sea level.	Monthly mean.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Maximum daily range.			
January.....	29.749	29.844	80.8	93	11	90	67	4	72	23	73	72	87
February.....	29.774	29.870	79.9	93	13	90	66	22	70	25	72	70	83
March.....	29.752	29.847	82.0	95	21	92	68	16	72	25	72	70	78
April.....	29.752	29.847	81.6	96	27	92	66	22	72	27	73	71	76
May.....	29.744	29.838	80.2	95	1	88	70	27	72	22	75	74	88
June.....	29.732	29.828	80.2	93	9	88	70	12	73	19	76	74	89
July.....	29.735	29.830	81.1	93	21	89	71	2	73	20	76	75	90
August.....	29.721	29.816	80.2	93	13	88	70	7	72	20	75	74	91
September.....	29.719	29.814	79.6	92	1	86	69	9	73	20	75	75	91
October.....	29.741	29.836	79.5	92	16	87	70	9	72	20	75	75	92
November.....	29.708	29.803	79.0	91	7	86	70	14	72	20	75	74	92
December.....	29.745	29.840	80.0	92	24	89	68	5	71	21	74	73	89
Year.....	29.739	29.834	80.3	96	² 27	88.8	66	³ 22	72.0	27	74.2	73.1	87.2

Month.	Precipitation (inches).			Wind.					Number of days.				Average cloudiness. ⁵
	Monthly total.	Normal. ⁴	Rainy days.	Total movement (miles).	Prevailing direction.	Maximum velocity.			Clear.	Partly cloudy.	Cloudy.	Thunder storms.	
						Miles per hour.	Direction.	Date.					
January.....	0.63	0.99	8	5,451	NW.	21	N.	29	10	15	6	4	5.0
February.....	.22	.81	4	6,247	NW.	26	N.	10	15	13	0	0	3.6
March.....	.43	.76	1	7,898	NW.	26	NW.	23	12	19	0	0	4.4
April.....	.03	2.58	1	6,971	NW.	24	N.	2	2	23	5	2	6.0
May.....	8.27	8.93	19	5,002	NW.	20	N.	1	0	2	29	14	8.8
June.....	8.15	8.15	19	3,978	NW.	32	S.	11	3	7	20	18	7.4
July.....	4.85	7.97	22	5,158	NW.	21	N.	24	7	22	2	20	5.2
August.....	8.20	7.57	20	4,640	NW.	22	SE.	21	1	25	5	23	6.1
September.....	11.43	7.69	26	4,497	NW.	25	N.	28	2	24	4	18	5.5
October.....	8.30	10.77	24	4,276	NW.	22	N.	11	8	19	4	21	5.3
November.....	10.63	10.46	27	3,009	NW.	25	N.	21	2	24	4	21	5.9
December.....	4.84	4.22	9	5,547	NW.	22	NW.	10	13	16	2	3	4.3
Year.....	65.98	70.90	180	62,674	NW.	32	S.	⁶ 11	75	209	81	144	5.6

¹ Elevation of barometer 92 feet above sea level.² April.³ February.⁴ Average for 16 years' record.⁵ Tenths of sky.⁶ June.

TABLE NO. 4.—*Monthly meteorological data—Culebra, Canal Zone, year 1913.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).								Mean wet thermometer.	Mean temperature dew point.	Mean relative humidity.
	Station. ¹	Sea level.	Monthly mean.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Maximum daily range.			
January.....	29.442	29.856	78.7	90	8	87	64	4	71	22	72	71	89
February.....	29.472	29.887	78.0	90	21	87	66	4	69	24	70	69	86
March.....	29.450	29.863	79.8	92	27	89	67	16	70	23	72	70	82
April.....	29.444	29.856	80.1	95	14	90	65	20	70	27	72	70	80
May.....	29.437	29.850	79.7	91	5	87	69	27	72	20	74	73	91
June.....	29.424	29.837	80.1	92	5	88	69	24	72	22	74	74	91
July.....	29.432	29.844	80.1	90	24	87	71	4	73	18	75	74	91
August.....	29.416	29.828	79.2	92	1	86	70	7	72	19	74	74	94
September.....	29.410	29.822	79.1	91	23	86	70	9	72	18	74	74	94
October.....	29.430	29.844	78.9	90	19	86	69	9	72	18	74	74	95
November.....	29.400	29.813	78.2	89	7	84	70	5	72	18	74	74	96
December.....	29.436	29.850	78.5	88	24	86	68	6	71	19	73	73	94
Year.....	29.433	29.846	79.2	95	14	86.9	64	4	71.3	27	73.2	72.5	90.2

Month.	Precipitation (inches).			Wind.					Number of days.				Average cloudiness. ⁶
				Total movement (miles).	Prevailing direc- tion.	Maximum velocity.							
	Monthly total.	Normal. ⁴	Rainy days.			Miles per hour.	Direction.	Date.	Clear.	Partly cloudy.	Cloudy.	Thunder- storms.	
January.....	1.57	1.74	6	6,142	NW.	27	N.	29	13	12	6	4	4.6
February.....	.78	.57	6	6,513	NW.	28	NW.	10	15	13	0	0	3.7
March.....	.57	.68	2	8,083	NW.	33	N.	8	16	15	0	0	3.7
April.....	.71	3.66	4	7,006	NW.	28	N.	4	8	19	3	1	5.0
May.....	11.74	11.18	24	4,921	NW.	26	SE.	7	0	11	20	18	8.0
June.....	9.10	8.87	19	3,695	NW.	31	S.	11	1	11	18	15	7.5
July.....	5.52	9.34	22	5,313	NW.	25	N.	19	0	8	23	17	8.4
August.....	9.76	10.54	25	4,588	NW.	40	NE.	27	0	4	27	23	8.9
September.....	10.55	11.20	26	4,043	NW.	25	NE.	24	0	9	21	16	8.0
October.....	6.08	11.32	21	3,845	NW.	30	NE.	11	0	9	22	14	8.5
November.....	11.21	12.26	26	4,192	NW.	40	NE.	19	0	1	29	11	9.2
December.....	1.50	7.41	14	5,820	NW.	23	NW.	8	7	12	12	1	6.1
Year.....	69.09	88.77	195	64,161	NW.	40	NE.	19	60	124	181	120	6.8

¹ Elevation of barometer 404 feet above sea level.

² April.

³ January.

⁴ Average for 23 years' record.

⁵ Tenths of sky.

⁶ November.

TABLE NO. 5.—*Monthly meteorological data—Colon, R. P., year 1913.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).								Mean wet thermometer.	Mean temperature dew point.	Mean relative humidity.
	Station. ¹	Sea level.	Monthly mean.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Maximum daily range.			
January.....	29.864	29.875	80.8	87	7	85	72	31	77	12	75	73	82
February.....	29.897	29.908	80.0	86	27	84	71	4	76	13	73	71	78
March.....	29.878	29.890	81.4	87	25	85	73	26	78	12	74	72	78
April.....	29.872	29.884	80.8	87	25	84	73	21	77	10	74	72	78
May.....	29.859	29.870	79.4	86	6	83	73	28	75	12	76	75	87
June.....	29.843	29.854	80.2	91	22	85	73	11	76	17	76	75	88
July.....	29.856	29.868	80.6	88	17	84	73	8	77	14	77	76	87
August.....	29.835	29.846	79.8	87	3	83	72	21	76	13	77	76	89
September.....	29.826	29.838	80.2	89	27	85	73	9	76	14	76	75	88
October.....	29.847	29.858	79.5	88	19	84	72	20	75	15	76	75	88
November.....	29.820	29.831	79.2	88	16	83	72	14	76	12	76	75	90
December.....	29.865	29.876	79.7	86	8	84	72	12	76	13	76	74	84
Year.....	29.855	29.866	80.1	91	22	84.1	71	8	76.2	17	75.5	74.1	84.8

Month.	Precipitation (inches).			Wind.					Number of days.—				Average cloudiness. ⁵
				Total movement (miles).	Prevailing direction.	Maximum velocity.							
	Monthly total.	Normal. ⁴	Rainy days.			Miles per hour.	Direction.	Date.	Clear.	Partly cloudy.	Cloudy.	Thunderstorms.	
January.....	6.71	4.03	17	10,034	NE.	30	NE.	22	14	13	4	0	4.5
February.....	1.75	1.48	10	8,886	N.	32	NE.	10	15	12	1	0	4.0
March.....	.79	1.65	17	12,158	N.	36	NE.	17	10	20	1	0	4.4
April.....	2.69	4.05	14	9,283	N.	28	N.	4	8	17	5	2	5.1
May.....	22.60	12.65	26	6,875	N.	30	SW.	21	0	17	14	16	7.1
June.....	11.81	13.32	22	5,420	SE.	27	S.	11	4	11	15	15	6.8
July.....	15.13	16.35	24	7,281	NE.	29	NE.	12	4	12	15	20	7.0
August.....	17.91	15.08	26	7,013	W.	26	W.	10	2	16	13	22	6.9
September.....	9.90	12.47	22	5,555	SE.	27	W.	3	4	9	17	13	7.0
October.....	18.63	14.38	21	5,627	SE.	36	N.	20	4	11	16	17	6.8
November.....	16.75	21.74	26	6,515	NE.	36	N.	14	0	9	21	11	8.2
December.....	6.55	12.18	21	8,753	N.	32	NE.	28	10	14	7	3	5.2
Year.....	131.22	129.38	246	93,405	N.	36	N.	14	75	161	129	119	6.1

¹ Elevation of barometer, 10 feet above sea level.² June.³ February.⁴ Average for 43 years' record.⁵ Tenths of sky.⁶ November.

TABLE No. 6.—*Monthly evaporation, Canal Zone, years 1913, 1914, and averages.*

[Values in inches.]

Month.	Ancon.			Rio Grande.			Gatun.		
	1913	1914	Average (6 years).	1913	1914	Average (5 years).	1913	1914	Average (3 years).
January.....	5.935	6.924	5.063	5.392	5.520	5.565	5.435	4.821	5.821
February.....	6.439	8.014	5.560	5.844	5.965	5.677	6.839	6.298	6.412
March.....	7.816	8.506	6.702	6.762	7.062	6.878	8.602	7.504	7.918
April.....	6.465	6.227	5.089	6.436	6.413	5.651	7.333	6.688	7.138
May.....	3.963	4.143	3.284	4.033	4.870	4.304	4.606	5.262	5.068
June.....	3.615	3.280	2.859	3.812	3.733	3.473	5.083	4.558	3.715
July.....	3.858	.....	3.158	3.963	.....	3.765	4.664	.....	4.371
August.....	3.908	.....	3.169	3.901	.....	3.779	4.570	.....	4.431
September.....	4.006	.....	3.268	3.783	.....	3.732	4.934	.....	4.439
October.....	4.169	.....	3.457	3.758	.....	3.623	4.844	.....	4.192
November.....	3.379	.....	3.027	2.741	.....	2.957	3.560	.....	3.197
December.....	4.700	.....	4.137	4.525	.....	4.205	4.291	.....	4.825
Year.....	58.253	.....	48.773	54.950	.....	53.609	64.811	.....	61.527

Month.	Brazos Brook.			Colon.		
	1913	1914	Average (5 years).	1913	1914	Average (5½ years).
January.....	6.387	6.331	5.940	5.993	6.125	5.879
February.....	6.616	6.456	5.685	5.915	5.974	6.146
March.....	8.455	7.769	7.266	7.702	6.519	7.301
April.....	7.466	(¹)	6.023	7.179	5.643	6.207
May.....	4.167	.....	4.413	3.731	4.020	3.633
June.....	4.500	.....	3.694	3.414	3.394	2.985
July.....	4.277	.....	3.823	3.370	.....	2.902
August.....	4.248	.....	3.975	3.129	.....	3.090
September.....	4.934	.....	4.299	3.555	.....	3.237
October.....	4.343	.....	4.119	3.328	.....	3.367
November.....	3.071	.....	2.881	3.000	.....	2.805
December.....	4.747	.....	3.982	4.626	.....	4.004
Year.....	63.211	.....	56.100	54.942	.....	51.556

¹ Station closed Apr. 1, 1914.

NOTE.—Insulated tanks 10 inches in diameter at Ancon and Colon. Water surface protected from action of sun and rain.

Exposed pans 4 feet in diameter and 10 inches deep floating in water at Rio Grande, Brazos Brook, and Gatun.

For monthly evaporation during past years, see previous annual reports.

TABLE No. 7.—*Tidal conditions, year 1913.*

[Elevations in feet refer to mean sea level.]

PACIFIC COAST—BALBOA, CANAL ZONE.

Month.	Maximum high.	Date.	Extreme low	Date.	Maximum amplitude. ¹	Date.	Minimum amplitude. ¹	Date.
January.....	+10.0	25	— 9.7	25	19.7	25	6.7	17
February.....	+ 9.9	23	—10.6	22-23	20.5	23	6.5	16
March.....	+10.3	23	—10.4	24	20.4	24	6.2	2
April.....	+ 8.8	22	—10.5	21	19.2	21	6.1	1-29
May.....	+ 8.6	19-20	— 8.5	20-21	17.1	20	6.5	1
June.....	+ 8.1	7	— 7.5	6	15.5	7	6.8	29
July.....	+ 9.3	7-8	— 7.8	6	17.0	6	6.5	29
August.....	+10.2	6	— 8.8	4	18.9	5-6	6.4	27
September.....	+10.7	3-4	— 9.3	2	20.0	3	6.6	25
October.....	+10.9	2	— 9.6	2	20.5	2	6.3	9
November.....	+10.0	1	— 8.6	1	18.6	1	6.7	7
December.....	+ 8.4	1	— 7.8	29	15.4	(²)	6.5	7
Year.....	+10.9	(³)	—10.6	(⁴)	20.5	(⁵) (⁶)	6.1	(⁶)

¹ For consecutive tides.² Several dates.³ Oct. 2.⁴ Feb. 22-23.⁵ Feb. 23.⁶ Apr. 1-29.

TABLE No. 7.—*Tidal conditions, year 1913—Continued.*

ATLANTIC COAST—COLON, PANAMA.

Month.	Maximum high.	Date.	Extreme low.	Date.	Maximum amplitude.	Date.	Minimum amplitude.	Date.
January.....	+1.44	22	—0.50	30	1.79	22	0.20	20
February.....	+1.11	20	— .74	18	1.70	18	.22	1
March.....	+1.01	17	— .69	27	1.68	27	.21	16
April.....	+1.02	19	— .58	13	1.52	25	.20	13
May.....	+1.18	21	— .58	22	1.68	21-22	.20	26
June.....	+1.28	5	— .53	23	1.66	17	.23	12
July.....	+1.23	31	— .65	16	1.71	5	.24	26
August.....	+1.48	29	— .32	2	1.64	12	.21	29
September.....	+1.43	9-25	— .19	8	1.54	24	.21	13-25
October.....	+1.39	3	— .45	31	1.59	31	.21	3-23
November.....	+1.66	15	— .49	29	1.84	27	.26	24
December.....	+1.35	24	— .50	12	1.73	26	.20	21
Year.....	+1.66	(¹)	— .74	(²)	1.84	(³)	.20	(⁴)
¹ Nov. 15. ² Feb. 18. ³ Nov. 27. ⁴ Several dates.								

NOTE.—One tidal fluctuation is often entirely absent at Colon.

TABLE No. 8.—*Seismograph records, Ancon, Canal Zone, year ended June 30, 1914.*

[Latitude, 8° 57' north; longitude, 79° 32' west.]

[100 K. Bosh-Omori seismographs. Greenwich mean time, midnight to midnight.]

Date.	Component.	Time of beginning.		Time of—		Maximum amplitude (millimeters).	Approximate distance of epicenter.	
		Preliminary tremors.	Long waves.	Maximum.	End.		Miles.	Probable direction.
1913.								
July 25.....	N-S.	11.38.00	11.39.00	11.39.00	11.49.00	0.5	225	(?)
	E-W.	11.38.00	11.39.00	11.39.00	11.46.00	0.5	.....	
July 25.....	N-S.	12.39.00	12.40.00	12.40.00	13.15.00	12.5	225	(?)
	E-W.	12.39.00	12.40.00	12.41.00	13.02.00	9.5	.....	
July 28.....	N-S.	5.45.00	5.50.00	5.50.00	6.20.00	2.5	1,050	(?)
	E-W.	5.45.00	5.50.00	5.52.00	6.10.00	0.5	.....	
Aug. 6.....	N-S.	22.20.00	22.25.00	22.26.00	23.23.00	40.0	1,000	(?)
	E-W.	22.20.00	22.25.00	22.26.00	23.15.00	25.0	.....	
Aug. 7.....	N-S.	(?)	2.22.00	2.22.00	2.36.00	0.7	(?)	(?)
	E-W.	(?)	2.22.00	2.22.00	2.31.00	0.5	.....	
Aug. 7.....	N-S.	(?)	16.23.00	16.23.00	16.26.00	1.0	Local.	(?)
	E-W.	(?)	16.23.00	16.23.00	16.25.00	0.7	.....	
Aug. 9.....	N-S.	(?)	5.42.00	5.42.00	5.44.00	.....	(?)	(?)
	E-W.	(?)	5.42.00	5.42.00	5.44.00	.....	(?)	(?)
Aug. 9.....	N-S.	(?)	18.56.00	18.56.00	19.01.00	1.0	(?)	(?)
	E-W.	(?)	(?)	(?)	(?)	.....	(?)	(?)
Aug. 10.....	N-S.	17.33.00	17.34.00	17.34.00	17.38.00	0.5	(?)	(?)
	E-W.	17.33.00	17.34.00	17.34.00	17.38.00	0.2	.....	
Sept. 12.....	N-S.	(?)	20.42.00	20.43.00	21.09.00	0.3	Distant.	(?)
	E-W.	(?)	20.42.00	20.43.00	21.04.00	0.3	.....	
Oct. 1.....	N-S.	18.48.00	18.50.00	18.50.00	19.06.00	2.0	350	(?)
	E-W.	18.48.00	18.50.00	18.50.00	19.04.00	3.0	.....	
Oct. 2.....	N-S.	4.24.50	4.25.10	Pen off.	5.40.00	75.0+	115	SW.
	E-W.	4.24.50	4.25.10	Pen off.	5.40.00	75.0+	.....	
Oct. 2.....	N-S.	5.59.50	6.00.10	6.04.40	6.29.50	3.0	115	SW.
	E-W.	5.59.50	6.00.10	6.04.40	6.20.00	3.0	.....	
Oct. 2.....	N-S.	7.27.00	7.27.20	7.27.30	7.29.00	0.3	115	SW.
	E-W. ¹	.....	.....	.....	.....	.....	.....	
Oct. 2.....	N-S.	8.10.50	8.11.10	8.11.20	8.18.00	3.0	115	SW.
	E-W.	8.10.50	8.11.10	8.11.20	(?)	7.0	.....	
Oct. 2.....	N-S.	8.48.00	8.48.20	8.48.25	8.55.00	3.0	115	SW.
	E-W.	8.48.00	8.48.20	8.48.25	8.50.00	2.0	.....	
Oct. 2.....	N-S.	10.18.05	10.18.25	10.18.30	10.21.00	0.7	115	SW.
	E-W. ¹	.....	.....	.....	.....	.....	.....	
Oct. 2.....	N-S.	12.28.00	12.28.20	12.28.25	12.42.00	3.0	115	SW.
	E-W.	(?)	(?)	12.28.25	12.36.00	2.0	.....	
Oct. 2.....	N-S.	13.41.10	13.41.30	13.42.30	14.10.00	3.0	115	SW.
	E-W.	13.41.10	13.41.30	13.42.30	14.04.00	2.0	.....	

¹No record on east-west component.

TABLE No. 8.—*Seismograph records, Ancon, Canal Zone, year ended June 30, 1914—Continued.*

Date.	Component.	Time of beginning.		Time of—		Maximum amplitude de (millimeters)	Approximate distance of epicenter.	
		Preliminary tremors.	Long waves.	Maximum.	End.		Miles.	Probable direction.
1913.								
Oct. 2.....	N-S.	14.45.00	14.45.20	14.46.00	15.00.00	2.5	115	SW.
	E-W.	14.45.00	14.45.20	14.46.00	15.00.00	2.0	.....	.....
Oct. 2.....	N-S.	19.07.30	19.07.50	19.08.00	19.10.00	0.2	115	SW.
	E-W.	19.07.30	19.07.50	19.08.00	19.10.00	0.2	.....	.....
Oct. 2.....	N-S.	21.53.10	21.53.30	21.54.00	21.55.00	0.1	115	SW.
	E-W.	21.53.10	21.53.30	21.54.00	21.55.00	0.1	.....	.....
Oct. 2.....	N-S.	22.49.00	22.49.20	22.50.00	22.52.00	0.1	115	SW.
	E-W.	22.49.00	22.49.20	22.50.00	22.52.00	0.1	.....	.....
Oct. 3.....	N-S.	4.18.50	4.19.10	4.19.20	4.21.00	0.3	115	SW.
	E-W.	4.18.50	4.19.10	4.20.00	4.21.00	0.3	.....	.....
Oct. 3.....	N-S.	6.12.50	6.13.10	6.13.25	6.14.00	0.2	115	SW.
	E-W.	6.12.50	6.13.10	6.13.25	6.14.00	0.2	.....	.....
Oct. 3.....	N-S.	10.23.30	10.23.50	10.25.00	10.38.00	1.5	115	SW.
	E-W.	10.23.30	10.23.50	10.25.00	10.27.00	1.0	.....	.....
Oct. 4.....	N-S.	4.35.30	4.35.50	4.36.00	4.40.00	0.3	115	SW.
	E-W.	4.35.30	4.35.50	4.36.00	4.40.00	0.1	.....	.....
Oct. 4.....	N-S.	10.28.30	10.28.50	10.29.00	10.32.00	1.0	115	SW.
	E-W.	10.28.30	10.28.50	10.29.00	10.31.00	1.0	.....	.....
Oct. 4.....	N-S.	10.43.40	10.44.00	10.44.05	10.48.00	1.5	115	SW.
	E-W.	10.43.40	10.44.00	10.44.05	10.48.00	2.0	.....	.....
Oct. 4.....	N-S.	22.06.00	22.06.20	Pen off.	23.20.00	75.0+	115	SW.
	E-W.	22.06.00	22.06.20	Pen off.	23.20.00	75.0+	.....	.....
Oct. 4.....	N-S.	23.58.40	23.59.00	23.59.10	0.06.30	8.0	115	SW.
	E-W.	23.58.40	23.59.00	23.59.10	0.05.00	8.0	.....	.....
Oct. 5.....	N-S.	0.18.00	0.18.20	0.18.30	0.20.00	9.0	115	SW.
	E-W.	0.18.00	0.18.20	0.18.30	0.20.00	3.5	.....	.....
Oct. 5.....	N-S.	22.00.00	22.00.20	22.00.30	22.02.00	0.4	115	SW.
	E-W.	22.00.00	22.00.20	22.00.30	22.02.00	0.4	.....	.....
Oct. 6.....	N-S.	7.37.00	7.37.20	7.37.30	7.38.30	0.1	115	SW.
	E-W.	7.37.00	7.37.20	7.37.30	7.38.30	0.1	.....	.....
Oct. 8.....	N-S.	2.23.00	2.23.20	2.23.30	2.25.00	0.5	115	SW.
	E-W.	2.23.00	2.23.20	2.23.30	2.25.00	0.5	.....	.....
Oct. 8.....	N-S.	(?)	21.58.35	21.58.35	22.00.00	0.2	(?)	(?)
	E-W.	(?)	21.58.35	21.58.35	22.00.00	0.2	.....	.....
Oct. 9.....	N-S.	1.52.00	1.52.20	1.52.30	1.54.00	0.2	115	SW.
	E-W.	1.52.00	1.52.20	1.52.30	1.54.00	0.2	.....	.....
Oct. 9.....	N-S.	18.37.30	18.38.30	18.40.00	19.00.00	19.0	350	(?)
	E-W.	18.37.30	18.38.30	18.39.30	19.00.00	9.0	.....	.....
Oct. 12.....	N-S.	0.46.40	0.47.00	0.47.05	1.25.00	45.0	115	SW.
	E-W.	0.46.40	0.47.00	Pen off.	1.15.00	(?)	.....	.....
Oct. 12.....	N-S.	4.24.05	4.24.25	4.24.30	4.27.00	0.5	115	SW.
	E-W.	4.24.05	4.24.25	4.24.30	4.27.00	0.4	.....	.....
Oct. 12.....	N-S.	12.00.10	12.00.30	12.00.35	12.03.00	1.0	115	SW.
	E-W.	12.00.10	12.00.30	12.00.35	12.03.00	1.0	.....	.....
Oct. 12.....	N-S.	22.38.00	22.38.20	22.38.50	22.44.00	0.5	115	SW.
	E-W.	22.38.00	22.38.20	22.38.50	22.44.00	0.5	.....	.....
Oct. 17.....	N-S.	0.21.55	0.22.15	0.22.20	0.22.55	0.2	115	SW.
	E-W.	0.21.55	0.22.15	0.22.20	0.22.55	0.2	.....	.....
Oct. 23.....	N-S.	15.01.35	Pen off.	Pen off.	Pen off.	(?)	115?	SW.?
	E-W.	15.01.35	Pen off.	Pen off.	Pen off.	(?)	.....	.....
Oct. 24.....	N-S.	0.25.20	0.25.40	0.25.50	0.35.00	5.0	115	SW.
	E-W.	0.25.20	0.25.40	0.25.40	0.35.00	5.0	.....	.....
Oct. 24.....	N-S.	2.34.30	2.34.50	2.35.30	2.40.00	1.0	115	SW.
	E-W.	2.34.30	2.34.50	2.35.00	2.40.00	0.5	.....	.....
Oct. 24.....	N-S.	5.17.00	5.17.20	5.17.50	5.22.00	0.6	115	SW.
	E-W.	5.17.00	5.17.20	5.17.30	5.22.00	0.6	.....	.....
Oct. 25.....	N-S.	14.35.30	14.35.50	14.36.00	14.38.00	0.2	115	SW.
	E-W.	14.35.30	14.35.50	14.36.00	14.38.00	0.2	.....	.....
Oct. 26.....	N-S.	22.40.10	22.40.30	22.40.30	22.42.00	0.2	115	SW.
	E-W.	22.40.10	22.40.30	22.40.30	22.42.00	0.2	.....	.....
Nov. 13.....	N-S.	11.54.05	Pen off.	(?)	12.40.00	75.0+	(?)115	SW(?).
	E-W.	11.54.05	Pen off.	(?)	12.40.00	75.0+	.....	.....
Nov. 24.....	N-S.	(?)	8.00.00	8.10.00	8.38.00	0.3	Distant.	(?).
	E-W.	(?)	8.00.00	8.30.30	8.38.00	0.7	.....	.....
Dec. 1.....	N-S.	22.23.30	22.29.30	22.30.00	22.40.00	2.0	300	(?).
	E-W.	22.23.30	22.29.30	22.30.00	22.40.00	1.5	.....	.....
Dec. 2.....	N-S.	(?)	18.57.40	18.58.00	19.02.00	0.2	(?)	(?).
	E-W.	(?)	18.57.40	19.00.00	19.02.00	0.2	.....	.....
Dec. 15.....	N-S.	13.35.10	13.35.30	13.35.35	13.39.00	1.5	115	SW.
	E-W.	13.35.10	13.35.30	13.35.35	13.39.00	1.5	.....	.....

TABLE No. 8.—*Seismograph records, Ancon, Canal Zone, year ended June 30, 1914—Continued.*

Date.	Component.	Time of beginning.		Time of—		Maximum amplitude (millimeters).	Approximate distance of center.	
		Preliminary tremors.	Long waves.	Maximum.	End.		Miles.	Probable direction.
1914.								
Jan. 17.....	N-S.	14.34.50	14.36.00	14.36.10	14.44.50	1.0	330	(?).
	E-W.	14.34.50	14.36.00	14.36.10	14.40.00	0.7		
Jan. 30.....	N-S.	3.44.00	3.51.00	3.51.00	5.35.00	1.0	1,450	(?).
	E-W.	3.44.00	3.51.00	3.54.30	5.20.00	0.7		
Feb. 7.....	N-S.	22.57.15	22.57.35	22.58.30	23.25.00	57.0	115	SW.
	E-W.	22.57.15	22.57.35	22.58.30	23.17.00	49.0		
Feb. 8.....	N-S.	1.27.00	1.27.20	1.27.30	1.37.00	2.0	115	SW.
	E-W.	1.27.00	1.27.20	1.27.30	1.35.00	1.5		
Feb. 8.....	N-S.	5.03.30	5.03.50	5.04.00	5.21.00	11.0	115	SW.
	E-W.	5.03.30	5.03.50	5.05.20	5.18.00	21.0		
Feb. 8.....	N-S.	6.31.00	6.31.20	6.31.30	6.35.00	1.0	115	SW.
	E-W.	6.30.00	6.31.20	6.31.30	6.33.00	1.0		
Feb. 8.....	N-S.	6.42.15	6.42.35	6.42.40	6.55.00	3.0	115	SW.
	E-W.	6.42.15	6.42.35	6.42.40	6.47.00	2.5		
Feb. 8.....	N-S.	11.06.10	11.06.30	11.06.35	11.13.00	1.5	115	SW.
	E-W.	11.06.10	11.06.30	11.06.35	11.11.00	2.0		
Feb. 8.....	N-S.	19.07.55	19.08.55	19.10.00	19.22.00	2.5	300	(?).
	E-W.	19.07.55	19.08.55	19.10.00	19.16.00	2.0		
Feb. 8.....	N-S.	19.32.55	19.33.55	19.35.00	19.40.00	0.5	300	(?).
	E-W.	19.32.55	19.33.55	19.35.00	19.37.00	0.5		
Feb. 8.....	N-S.	19.48.40	19.49.00	19.49.05	19.53.00	1.0	115	SW.
	E-W.	19.48.40	19.49.00	19.49.05	19.52.00	1.0		
Feb. 9.....	N-S.	6.56.20	6.56.40	6.56.45	7.01.00	3.0	115	SW.
	E-W.	6.56.20	6.56.40	6.56.45	7.01.00	2.0		
Feb. 10.....	N-S.	11.15.50	11.16.50	11.17.00	11.25.00	0.5	300	(?).
	E-W.	11.15.50	11.16.50	11.18.00	11.25.00	0.5		
Feb. 10.....	N-S.	16.23.15	Pens off.	(?)	16.48.00	75.0+	(?)115	SW(?).
	E-W.	16.23.15	Pens off.	(?)	16.45.00	75.0+		
Feb. 10.....	N-S.	16.49.55	16.50.15	16.51.00	17.13.00	30.0	115	SW.
	E-W.	16.49.55	16.50.15	16.51.00	17.05.00	42.5		
Feb. 10.....	N-S.	20.10.00	20.10.15	20.10.25	20.25.00	4.5	100	SW.
	E-W.	20.09.55	20.10.10	20.10.25	20.24.00	5.0		
Feb. 10.....	N-S.	23.20.50	23.21.50	23.22.00	23.29.00	1.5	300	(?).
	E-S.	23.20.55	23.21.55	23.22.00	23.27.00	1.5		
Feb. 16.....	N-S.	13.02.00	13.02.20	13.02.25	13.12.00	6.0	115	SW.
	E-W.	13.02.00	13.02.20	13.03.00	13.10.00	4.0		
Feb. 16.....	N-S.	13.47.30	13.47.50	13.48.00	13.55.00	1.5	115	SW.
	E-W.	13.47.30	13.47.50	13.48.30	13.52.00	0.7		
Feb. 16.....	N-S.	21.01.40	22.02.00	22.02.10	22.08.00	0.4	115	SW.
	E-W.	21.01.40	22.02.00	22.02.10	22.06.00	0.3		
Feb. 20.....	N-S.	13.09.40	13.10.40	13.10.45	13.13.00	0.7	300	(?).
	E-W.	13.09.40	13.10.40	13.11.20	13.13.00	0.5		
Feb. 24.....	N-S.	18.07.00	18.08.15	18.08.30	18.11.00	0.2	(?)	(?).
	E-W.	18.07.00	18.08.15	18.08.30	18.11.00	0.2		
Feb. 24.....	N-S.	21.34.10	21.36.00	21.38.00	21.52.00	3.0	565	(?).
	E-W.	21.34.20	21.36.10	21.38.00	21.51.00	2.0		
Feb. 26.....	N-S.	5.04.15	5.09.30	5.09.35	5.25.00	3.0	1,050	(?).
	E-W.	5.04.40	5.09.30	5.09.35	5.20.00	1.0		
Mar. 16.....	N-S.	(?)	8.23.00	8.23.30	8.28.00	3.0	Distant.	(?).
	E-W.	(?)	8.23.00	8.23.30	8.32.00	2.0		
Mar. 21.....	N-S.	19.38.00	19.39.30	19.41.30	19.56.00	5.0	500	(?).
	E-W.	19.38.00	19.39.30	19.39.45	19.47.00	4.0		
Mar. 30.....	N-S.	0.45.00	0.48.00	0.52.15	2.13.00	8.0	620	(?).
	E-W.	0.45.00	0.48.00	0.52.00	1.43.00	7.0		
Apr. 13.....	N-S.	21.05.20	21.06.10	21.06.20	21.15.00	7.5	250	W(?).
	E-W.	21.05.20	21.06.10	21.06.30	21.12.00	5.0		
Apr. 20.....	N-S.	13.31.10	13.32.00	Pens off.	14.20.00	35.0+	250	SW(?).
	E-W.	13.31.10	13.32.00	Pens off.	14.04.00	35.0+		
May 19.....	N-S.	0.27.15	0.28.30	0.29.45	0.50.00	15.0	370	SW(?).
	E-W.	0.27.15	0.28.30	0.28.50	0.40.00	9.0		
May 28.....	N-S.	3.24.50	3.25.05	Pens off.	3.54.00	75.0+	100	SW.
	E-W.	3.24.50	3.25.05	Pens off.	3.50.00	75.0+		
May 28.....	N-S.	17.24.10	17.24.25	17.24.30	17.26.00	0.5	100	SW.
	E-W.	17.24.10	17.24.25	17.24.30	17.25.00	0.5		
May 31.....	N-S.	10.34.30	10.34.45	10.34.50	10.37.00	10.0	100	SW.
	E-W.	10.34.30	10.34.45	10.34.45	10.37.00	3.0		

NOTES.—Period of pendulum, 25 seconds; magnification, 10; damping, medium. The amplitude indicates half of the complete range of maximum motion. Laska's formula used in computing distances of remote earthquakes (620 miles or more), and Omori's formula for earthquakes less than 620 miles distant.

HYDROGRAPHY.

General.—The main features for the year were the fillings of Gatun and Miraflores Lakes and their subsequent control of levels by means of spillway gates and auxiliary culvert valves, etc.

On June 27, 1913, with Gatun Lake elevation at 48.22, the sluice gates were closed and the final rise of the lake began. On July 1 the elevation was 48.75; August 1, 54.34; September 1, 60.42; October 1, 66; November 1, 72.46; December 1, 82.04; the spillway gates were operated on the 27th, 29th, 30th (seven gates), and 31st, the maximum elevation for the month being 84.80 on the 30th. The lake would have reached elevation 84.92 if the gates had not been operated. Since December 27 the lake level has been controlled between 85.14 and 84.13.

The total yield of the Gatun Lake watershed for the calendar year 1913 was 77 per cent of the yearly mean since May, 1908, and 78.3 per cent of the mean for the 24-year period (1890–1913). The run-off above Alhajuela was 87.5 per cent of the 24-year mean. The accompanying plates Nos. 102 and 105 compare the yield at Gatun and Alhajuela for the years 1905, 1912, and 1913 with the means. Plate No. 104 compares the total run-off, net run-off, land area run-off, storage, rainfall, and evaporation on lake for Gatun Lake watershed for the year 1913. The percentage of total run-off for the various quantities areas follows:

	Per cent.
Total run-off.....	100
Net run-off.....	91.6
Land area run-off.....	85.2
Storage.....	69.8
Rainfall on lake.....	14.8
Evaporation on lake.....	8.4

Table No. 9 gives the yield at Gatun and Alhajuela for the fiscal year 1913–14.

Plate No. 100 gives the hydrograph of Gatun Lake for the fiscal year.

The filling of Miraflores Lake began on October 1, when the Miraflores Lock culverts were closed, the lake elevation being 12. On the 10th of November the level had reached 51. After that date the level was controlled by means of the west lock culvert and since May 26 by operation of the spillway gates, usually with only partial openings of 1 to 5 feet. Prior to May the conditions of the channel below the spillway did not permit of gate operations. The discharge on these partial openings has been computed by means of the formula $Q = cbd\sqrt{2gh} = 8.02cbd\sqrt{h}$, where Q = discharge in cubic feet per second; C , coefficient of 0.66 to 0.67 for openings of width b , 12 to 20 or more times d , the depth of opening; h = head on center of opening (see Merriman ed. 1912, pp. 122, 123, and 128). Discharge curves have been constructed from this formula.

Plate No. 101 shows the hydrograph of Miraflores Lake since commencement of filling.

Plate No. 106 gives the discharge duration by days for 1913 at Alhajuela. Plate No. 107 shows the discharge duration by months at the same station for 24 years, 1890–1913, inclusive.

Plate No. 103 gives the rainfall, run-off, and percentage run-off for Gatun Lake watershed by months, with accumulated quantities for

1913. On this plate it is interesting to note the greater run-off "inches" for the total watershed area than for the land area, due to direct catchment of rainfall by the lake.

Plate No. 102 gives the mass curve for total yield at Gatun.

Table No. 10 gives the monthly maximum, minimum, and mean elevations for the Chagres River, Gatun and Miraflores Lakes, showing only partial year's record at the new stations, Monte Lirio, Pedro Miguel, and Juan Mina, on Gatun Lake, and on Miraflores Lake. The Pedro Miguel River instrument was moved to south end Pedro Miguel Locks on the rise of Miraflores Lake. The record for the four months before moving is incomplete, and hence is not given.

New concrete water-stage register towers of the "lighthouse type" were constructed and put in use as follows: Gatun Spillway, December 27, 1913; Gatun Lake, October 6, 1913; Gamboa Lake, November 8, 1913; Pedro Miguel Lake, October 26, 1913; Miraflores Lake, October 31, 1913.

Water-stage registers were installed at Monte Lirio on May 2, 1914, and at Juan Mina the last of April. Prior to that morning and evening, rod readings had been taken at each station. Special rod readings were taken in Culebra Cut at Gamboa, Empire Bridge, and Cucaracha Slide, during filling of Cut in October, also at Pedro Miguel before the register was installed.

There were no large freshets during the year, the largest being the ones of November 10 and 18, 1913, and May 21, 1914. Table No. 11 gives the data on the principal freshets. Tables Nos. 12 and 13 give slope data on freshets of November 10 and May 21, and show the effect of Gatun Lake in checking the rise at Gamboa. The maximum run-off since December, 1910, was at rate of 48,850 second-feet, November 8-9, when the lake rose from 73.80 to 74.88 feet in 24 hours.

Gatun.—The yield of Gatun Lake watershed was estimated from the spillway discharge and storage in Gatun Lake, as follows:

Total yield = Discharge $\pm$ Storage $\pm$ Evaporation.

Net yield = Discharge $\pm$ Storage.

Seventeen current-meter gaugings have been made at the cable gauging station below the concrete channel of the spillway on gate openings since December 27, all but one being on one or two gates, the three-gate measurement being unsatisfactory on account of the rough, turbulent condition of the water. On December 30, with seven gates open, the discharge was measured in the concrete channel by means of surface floats timed over a 440-foot course, giving a maximum velocity of 44 feet per second or 30 miles per hour and a total discharge of 63,200 second-feet or 9,030 second-feet per gate, lake elevation 84.66. On account of the roughness of the surface, it was impossible accurately to determine the depth of the water, the depths obtained along the east and west walls giving a mean of 6.1 feet. This discharge of 9,030 second-feet gives a coefficient of 3.204 in the Francis formula $Q = CLH^{3/2}$.

The mean of five current-meter measurements on one and two gates open, at the cable station from December 31 to January 6, on accurately determined cross section, mean lake height of 84.36, mean discharge per gate of 9,890, gives a coefficient in the same formula of 3.612. The mean of seven coefficients determined on gaugings of May and June gives 3.605, with one and two gates open. Three measurements of February gave coefficients of 3.418, 3.618, and 3.374.

Including those, the mean coefficient for 15 measurements is 3.58. More data will be obtained to determine accurately the coefficient to be used, which would seem to be about 3.60. Plate No. 108 shows changes in cross section at the gauging station for January, February, June, and July, 1914.

Five measurements were made on caisson leakages on open spillway gates at Miraflores and Gatun, giving from 26 to 53 cubic feet per second. From these figures estimates are made from time to time, running from 30 to 70 cubic feet per second per caisson, with an average of about 50 cubic feet per second per caisson.

Gamboa.—Velocity observations on several freshets have been made at Gamboa Bridge, the maximum obtained being on November 10, 1913, 2.6 miles per hour, lake at 75.7, maximum discharge at Alhajuela 36,000 cubic feet per second, gates closed at Gatun. On May 26, lake at 84.92, rising to 84.98, the maximum velocity was 0.653 mile per hour, Alhajuela maximum discharge 15,900 cubic feet per second, one gate open at Gatun. On June 30, lake falling 84.88 to 84.86, the maximum velocity was 1.05 miles per hour, Alhajuela maximum discharge 20,050 cubic feet per second, and four gates open at Gatun. All observations at 1 foot depth.

Alhajuela.—Ninety-five current-meter measurements have been made on the main river at the Calle Larga gauging station from elevations 90.91 to 101, on the whole checking the discharge curve satisfactorily. Ten check gaugings were made in the upper tributaries at Dos Bocas (the forks of the Chagres), the results being satisfactory. Gaugings were made in the lower tributaries as follows: Chilibrillo, 7; Chilibre, 17; Gatuncillo, 35; but gaugings have been discontinued on these streams due to the rise of Gatun Lake.

Vigia.—Continued in operation as flood-warning station.

Rating station.—Current meters were rated, as needed, at the Gamboa station. This was flooded by Gatun Lake and a new station has been located on the east arm of Miraflores Lake at Pedro Miguel. This will be in shape for rating this month. An experimental determination is to be made in the near future on the leakage of the rising stem valves at the various locks, where conditions permit. The figures that have been used heretofore were (for 30-day month) 2.1 second-feet at Gatun Locks, 1.5 at Pedro Miguel, 2.09 and 3.09 at Miraflores. These were thought by the engineer of maintenance to be too low, so on the June reports the figures were changed to 6 for Gatun, 4.1 for Pedro Miguel, and 5.32 for Miraflores, using as a basis experiments conducted by Testing Engineer Whitehead at Pedro Miguel, which gave a leakage for one pair of valves of 1.36 cubic feet per second under 32-foot head. From this, using proportional heads and the formula $V = V_2gh$, the amounts were determined for the other locks, as above.

SPECIAL INVESTIGATIONS.

Currents in Colon Harbor.—This work was conducted on 12 days in January and February, 1913, and during the two entire months of June and July, 1913, being under way at the time of the last annual report. The general scheme followed was to trace the courses taken by floats, placed at different points in Limon Harbor, using on the

June-July work double copper floats consisting of an air-tight cylindrical copper can surface float, 6 inches in diameter, with small mast and flag. This was connected to the lower float of two sheet-copper wings 6 by 48 inches, one above the other, at right angles, by means of wire adjustable to any desired depth of submergence. The surface floats, i. e., within 8 feet of the surface, followed generally the direction of the prevailing winds, while the deeper floats, 15 to 25 feet depth, followed undercurrents in the direction of the heavy sea swells when such prevailed, the range of tide being so small that practically no effect of it was noticeable. The maximum velocities observed were only 2,300 and 3,400 feet per hour, general averages running from 500 to 2,000 feet per hour.

The data obtained indicates that there is no scour as there are no fixed currents and the velocities are too low to produce a scour under any conditions, which demand a velocity of 5,400 feet per hour to scour the bottom (see April, 1913, Proceedings Am. Soc. C. E., H. de B. Parsons on "Tidal phenomena in New York Harbor"), and that the surface currents are due entirely to local winds blowing over the harbor, while the deeper currents are governed by the heavy sea swells which stir up the silt on the bottom and aid in depositing it in the deeper portions of the bay, especially in the dredged channels. The ocean currents that sweep the coast are eastward bound and do not enter the inner bay on account of the west breakwater.

Leakage at Gatun spillway gates.—These investigations were made to study the variation in leakage, with special attention given to the function of temperature, and were conducted December 23–25, 1913, before the gates had been operated, after filling of the lake, and again from March 12–14, 1914, after several gate operations during the preceding months showing greater leakage than in December, as will be seen by the attached plates Nos. 109 and 110. The total leakage was collected at the head of the spillway channel by means of a cofferdam 24 inches high in December and 30 inches high in March, made of dashboards set 2 feet apart and filled in with red clay and held to the floor by its own weight, with very little seepage, less than 1 per cent of the weir discharge. The flow from the weep holes and the spring at the foot of the "ogee" dam was stopped on the December test, but in March the spring was opened at 1.30 p. m. on the 13th at the request of the superintendent of erection.

The evaporation from the water surface formed by the cofferdam was measured by a 4-foot diameter floating pan morning and evening, and showed for the December test an average of 0.63 per cent of the total leakage and for March 0.66 per cent.

The rainfall was measured by standard gauge, time of precipitation being noted.

The discharge was measured by a 2-foot sharp-crested weir with complete end contractions set in the cofferdam with crest 1 foot from the floor in December and 14 inches in March, the head being measured by a hook gauge set in a still box about 4 feet from the weir, the average of five readings used, unless the water surface was absolutely quiet, as at night, when only one setting was necessary. Accompanying plate No. 109, December test, shows the continuous discharge curve with minimum of 0.70 second-feet at 6.30 a. m. December 24 and maximum period of 37 hours of 1.61 second-feet.

This also shows the discharge curve for the single gate No. 13, with curves of temperature of the steel at top, middle, and bottom of the gate; also centigrade temperatures of the atmosphere and of the water in the lake. Gate No. 13 was selected on account of its relatively small leakage, the ratio for December 24 for leakage of No. 13 and all gates being 10: 568, showing that No. 13 was leaking only one-fourth the average leakage per gate. The discharge curve shows that the leakage varied directly as the temperature at center and top of gate, the bottom temperature being more constant on account of contact with the water. The leakage was from the central part of the gates and was practically limited to the middle third for 90 per cent of the flow. The excess expansion of the top of gate, due to greater range in temperature, causes the gate to buckle upward in the center, this breaking the seal.

Plate No. 110 shows the discharge and temperature curves for the March test, no separate measurement being made on a single gate.

The following table compares the leakage for the two tests:

	Period.		Ratio.
	Dec. 23-25, 1913.	Mar. 12-14, 1914.	
	<i>Cubic foot-seconds.</i>	<i>Cubic foot-seconds.</i>	
Maximum.....	3.30	7.90	100:240
Minimum.....	.70	1.34	100:191
Mean 24 hours (midnight to midnight).....	1.76	3.64	100:207
Mean for test.....	¹ 1.61	² 3.65	100:227

¹ 37 hours.

² 49 hours.

After the March test the flow of the spring at the foot of the ogee was measured by a 90 per cent notched weir set in a cofferdam built around the 2½-inch pipe set in the floor to provide an escape for the discharge of the spring. This was found to be 0.139 cubic foot-second, being the mean of nine readings on March 21 and 23.

SEEPAGE WEST EMERGENCY DAM PIT, MIRAFLORES LOCKS.

Two weirs were installed to measure the flow, a 6-inch rectangular weir on February 9 and a 90 per cent notched weir on February 11, heads being observed morning and evening by hook-gauge readings, the weirs being removed on March 6. The average flow was at the rate of 0.28 second-foot for the period, the pit collecting seepage through a section of fill about 150 feet long and under a head of 5 feet.

HYDRAULIC CONDITIONS BELOW MIRAFLORES SPILLWAY.

A study of these conditions was made in April in an attempt to determine the elevation to which the water would rise in channel opposite the power plant if all seven gates were opened at the spillway. Using discharge of 90,000 cubic foot-seconds, the approximate elevation at the point where the channel wall drops from elevation +28 to +24 was found to be +22.15, but this elevation can not be

determined theoretically with any great degree of accuracy on account of the unusual conditions existing in the channel. A special report was submitted under date of May 18, 1914.

CURRENT OBSERVATIONS BELOW WEST LOWER OPERATING GATES AT
MIRAFLORES LOCKS.

(Plate 111.)

These were made at the request of the electrical and mechanical engineer, the object being to determine the direction and velocities of the currents caused by the mixing of the salt water with the fresh water from the lock on opening the operating gates. To determine the direction, specially designed blades and vanes were used, operating from floats or through a long vertical sleeve with a pointer above the surface of the water. To determine velocities at different elevations, four current meters were mounted 10 feet apart on a $\frac{3}{4}$ -inch pipe, supported vertically in center of the lock, about 10 feet from the direction indicator. (See plate No. 111.) Both the direction indicator and meter support were guyed in such a manner as to facilitate easy raising and lowering.

On plate No. 111 the uppermost meter is shown as No. 783, the second as No. 732, third as No. 211, and lowest as No. 377. Time referred to of opening and closing of miter gates begins with cracking of gates and ends with tight jointing. On all runs, gates were opened full for about 25 minutes and then closed, the lower guard gates remaining open full during the test runs. The flow of water through the culvert from the lock chamber to the sea, in equalizing, caused the direction indicator to fluctuate rapidly, due to the eddies set up.

Run No. 5, on plate No. 111, is selected as an example.

Tide: -0.3 foot rising.

Meters: No. 783 at elevation -2 feet; No. 732 at -12; No. 211 at -22; No. 377 at -32. Indicator vane at -25 feet.

Lower operating gates opened at 9.26 a. m.; closed 9.58 a. m.

Direction of currents: At elevation -5 and -10, out.

At elevation -25, out.

Average velocity: At elevation -2, 1.65 feet per second.

At elevation -12, 1.71 feet per second.

At elevation -22, 0.75 foot per second.

At elevation -32, 1.08 feet per second.

On plate No. 111, on a vertical base line, the velocity in is plotted to right, and velocity out, to left. The vertical depth, from mean sea level to floor of lock, -50 feet is the ordinate; for instance, in run No. 1, the direction of current determined by float at elevation -7.5 is out, and velocity at this point is 2 feet per second. Therefore, going down the vertical base line from 0 to -7.5 and horizontally to the left, the point on the curve is struck. These six curves show that the velocity is zero at some point between elevation -20 and -30. In runs 1, 2, 3, and 6, this neutral point is about elevation -24 and in Nos. 4 and 5 a little lower.

For runs 5 and 6, plate No. 111, which are typical, time intervals of one minute are plotted left to right; the velocity, feet per second, is plotted up when direction is *out* and down when direction is *in*. It has been assumed from the test runs that at a given elevation, the

direction of current is the same for all operations of gates, and this assumption was used in plotting curves. Plate No. 111 gives plan of lower end of locks.

A study was made of the maximum estimated velocity in the canal at Bas Obispo, that would be caused by the largest rise due to a freshet in the Mandingo River and Camacho diversions. This was estimated to be not over 1 mile per hour.

An investigation was made of the flow through culverts on Curundu River due to spring tides in September and report submitted.

Curves were submitted showing the filling of Culebra Cut in October and the effect of the blowing up of the dike at Gamboa on October 10.

An estimate of the time to be taken to fill Gatun Lake was satisfactory, while one made for the same on Miraflores Lake was not, due to short record of run-off on that watershed and to poor area and capacity curves of the lake. Checking the area curve by water let into and taken out of Miraflores Lake in November and December showed the survey area curve at elevation 51 to be about 40 per cent greater than by method just mentioned.

An estimate was made of the maximum rises possible on Miraflores Lake, giving 1.38 feet per hour under conditions of 1909, and 4.29 feet for 12 hours, and 9.59 feet for 24 hours, conditions of 1910.

On lockages at Pedro Miguel there has been noted an interesting surge of the water in Culebra Cut, ranging from a foot and a half and more at Pedro Miguel to about 0.2 foot at Gamboa, and are noticeable on the records at Juan Mina and San Pablo. Plate No. 112 shows the surge at the pontoon bridge at Paraiso on May 15.

The earthquake of May 27 produced a wave on the lakes, the automatic registers showing a movement of 0.3 foot at Gatun, 0.1 foot at Pedro Miguel, and 0.2 foot on Miraflores Lake. At Alhajuela, the movement was very slight.

During the last three months daily readings have been made on a 90 per cent notched weir, measuring the discharge of the spring on Mount Zion Hill at Culebra, giving an average of about 0.030 cubic foot-seconds.

Routine office and field work has been carried on and records kept satisfactorily.

The work of flood predictions, etc., has been handled from the office during the day and from the hydrographer's quarters at night. The lake is being held between 84.8 and 85, so that frequent operations of the Gatun spillway gates have to be made to control the elevation. Advice as to the time of gate operations and number of gates, is given by the hydrographer whenever freshet conditions indicate that such are necessary.

The following diagrams and plates accompany the hydrographical section of this report:

Plate No. 100. Hydrograph, Gatun Lake, July, 1913-June, 1914.

No. 101. Hydrograph, Miraflores Lake, October, 1913-June, 1914.

No. 102. Chagres River drainage basin, mass curve total yield, Gatun, 1905, 1912, and 1913, and mean since 1908.

No. 103. Gatun Lake watershed-rainfall, run-off and percentage run-off, year 1913.

No. 104. Gatun Lake watershed, mass curves total yield, net yield, land area yield, storage, rainfall, evaporation on lake surface.

No. 105. Mass curve of discharge at Alhajuela, 1905, 1912, 1913, and mean for 24 years.

Plate No. 106. Curve of discharge duration Alhajuela, 1913, by days.

No. 107. Curve of discharge duration, Alhajuela, 24 years, 1890-1913, inclusive, by months.

No. 108. Cross sections at cable gauging station, Gatun Spillway.

No. 109. Leakage of gates, Gatun Spillway, December 23-25, 1913.

No. 110. Leakage of gates, Gatun Spillway, March 12-14, 1914.

No. 111. Current observations below west lower operating gates, Miraflores Locks, April 4-7, 1914.

No. 112. Surge in Culebra Cut at Pontoon Bridge on May 15, 1914.

Table No. 9. Monthly discharge Chagres River, for Alhajuela and Gatun.

No. 10. Monthly maximum, minimum, and mean elevations for Chagres River, Gatun and Miraflores Lakes.

No. 11. Principal freshets, 1913-14.

No. 12. Data on slopes of Chagres River during freshet period, November 10-11, 1913.

No. 13. Data on slopes of Chagres and Gatun Lake during freshet of May 21-22, 1914.

TABLE NO. 9.—*Monthly discharge—Chagres River.*

ALHAJUELA.

[Drainage area, 427 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on watershed).
	Maximum.	Minimum.	Mean.	Per square mile.	
1913.					
July.....	13,200	1,020	2,005	4.70	5.419
August.....	16,680	1,315	2,530	5.92	6.825
September.....	20,000	1,700	2,802	6.56	7.319
October.....	15,300	1,685	2,653	6.21	7.159
November.....	34,000	1,830	6,168	14.44	16.111
December.....	5,590	1,720	2,328	5.45	6.283
1914.					
January.....	2,255	830	1,306	3.06	3.528
February.....	1,175	670	824	1.93	2.010
March.....	640	401	530	1.24	1.430
April.....	1,730	305	469	1.10	1.227
May.....	23,680	359	2,049	4.80	5.534
June.....	20,050	1,082	2,084	4.88	5.445

GATUN LAKE.

[Drainage area, 1,320 square miles.]

Month.	Mean. elevation (feet above mean sea level).	Area for mean elevation.	Spillway discharge.	Storage, (+increase; -decrease).	Evapora- tion from lake surface.	Run-off, net yield (4+5).	Total yield (4+5+6).
1913.							
July.....	52.02	Sq. miles. 94.7	Sec.-feet. 15	+ 5,364	384	5,369	5,753
August.....	57.32	105.6	0	+ 6,896	418	6,896	7,314
September.....	63.40	118.1	0	+ 7,292	521	7,292	7,813
October.....	69.32	130.4	2 181	+ 8,678	490	8,859	9,349
November.....	77.48	147.7	8 22	+ 15,295	472	15,317	15,789
December.....	83.66	160.5	8 109	+ 4,198	584	4,807	4,891
1914.							
January.....	84.54	162.6	1,026	+ 713	680	1,739	2,419
February.....	84.86	163.0	930	- 186	987	744	1,731
March.....	84.82	162.9	148	+ 19	1,062	167	1,229
April.....	84.82	162.9	169	+ 139	974	308	1,282
May.....	84.81	162.8	3,353	- 134	743	3,219	3,962
June.....	84.85	162.9	5,715.2	+ 69.4	665	5,785	6,450

¹ Gate leakage.

² Filling Culebra Cut, 176; lockage, 5.

⁸ From December, total outflow from lake, including lockages, leakage, pumping, etc.

TABLE NO. 10.—*Monthly maximum, minimum, and mean elevations for the fiscal year 1913-14.*

Month.	Gatun Lake.											
	Gatun.			Trinidad.			Monte Lirio.			Bohio.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
1913.												
July.....	54.34	48.75	52.02	54.29	48.69	51.98	.....	.....	.....	54.30	48.67	51.98
August.....	60.42	54.29	57.32	60.47	54.29	57.34	.....	.....	.....	60.43	54.30	57.34
September.....	66.00	60.42	63.40	65.99	60.47	63.40	.....	.....	.....	65.99	60.43	63.39
October.....	72.46	66.00	69.32	72.40	65.99	69.29	.....	.....	.....	72.43	65.99	69.29
November.....	82.04	72.46	77.48	81.95	72.40	77.42	.....	.....	.....	82.01	72.43	77.45
December.....	84.80	82.01	83.66	84.77	81.95	83.64	.....	.....	.....	84.81	82.01	83.67
1914.												
January.....	84.90	84.13	84.54	84.89	84.12	84.52	.....	.....	.....	84.92	84.16	84.56
February.....	85.00	84.72	84.86	84.96	84.74	84.84	.....	.....	.....	85.01	84.79	84.89
March.....	84.89	84.73	84.82	84.87	84.72	84.81	.....	.....	.....	84.90	84.78	84.85
April.....	84.89	84.77	84.82	84.86	84.74	84.79	.....	.....	.....	84.90	84.79	84.84
May.....	85.10	84.38	84.81	85.08	84.40	84.77	85.10	84.41	84.80	85.12	84.44	84.78
June.....	85.14	84.68	84.85	85.01	84.64	84.82	85.06	84.67	84.81	85.09	84.69	84.87
The year.....	85.14	48.75	76.00	85.08	48.69	75.97	85.10	84.41	84.80	85.12	48.67	75.99

Month.	Gatun Lake.											
	Frijoles.			San Pablo.			Gamboa.			Pedro Miguel.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
1913.												
July.....	54.39	48.76	52.05	54.36	48.74	52.03	54.35	48.80	52.10	.....	.....	.....
August.....	60.42	54.31	57.32	60.41	54.31	57.33	60.50	54.32	57.38	.....	.....	.....
September.....	65.93	60.42	63.34	65.94	60.41	63.36	65.98	60.52	63.41	.....	.....	.....
October.....	72.37	65.93	69.26	72.39	65.94	69.26	72.38	65.98	69.28	.....	.....	.....
November.....	81.97	72.37	77.42	81.96	72.39	77.45	81.93	72.37	77.41	80.95	72.34	77.31
December.....	84.79	81.97	83.65	84.82	81.96	83.66	84.77	81.93	83.60	84.80	80.10	83.45
1914.												
January.....	84.91	84.14	84.54	84.95	84.15	84.56	84.91	84.03	84.50	85.08	83.95	84.51
February.....	85.00	84.74	84.87	85.01	84.75	84.88	84.97	84.70	84.84	85.78	83.87	84.85
March.....	84.86	84.75	84.81	84.92	84.79	84.84	84.87	84.73	84.80	85.37	84.22	84.80
April.....	84.90	84.75	84.81	84.90	84.78	84.84	84.92	84.66	84.79	85.45	84.10	84.79
May.....	85.10	84.42	84.75	85.10	84.42	84.77	85.03	84.31	84.75	85.46	83.82	84.80
June.....	85.04	84.67	84.85	85.03	84.69	84.85	85.01	84.53	84.79	85.64	84.00	84.81
The year.....	85.10	48.76	75.97	85.10	48.74	75.99	85.08	48.80	75.97	85.78	72.34	83.66

Month.	Gatun Lake.			Chagres River.						Mirafleres Lake at south end of Pedro Miguel Locks.		
	Juan Mina.			Alhajuela.			Vigia.			Maxi- mum.	Mini- mum.	Mean.
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.			
1913.												
July.....	.....	.....	.....	98.00	92.15	92.98	134.20	125.70	126.65	.....	.....	.....
August.....	.....	.....	.....	99.10	92.44	93.40	135.20	125.95	127.08	.....	.....	.....
September.....	.....	.....	.....	99.65	92.72	93.42	136.20	126.20	127.08	.....	.....	.....
October.....	.....	.....	.....	98.35	92.71	93.34	134.60	126.25	127.02	.....	.....	.....
November.....	.....	.....	.....	103.80	92.80	95.16	141.90	126.30	129.46	51.45	45.26	49.68
December.....	.....	.....	.....	95.00	92.70	93.19	129.30	126.15	126.72	51.23	50.35	50.74
1914.												
January.....	.....	.....	.....	93.15	91.80	92.30	126.65	125.30	125.77	51.11	50.08	50.67
February.....	.....	.....	.....	92.18	91.43	91.69	125.60	125.00	125.21	52.61	50.76	51.79
March.....	.....	.....	.....	91.43	91.06	91.26	125.00	124.70	124.82	52.01	50.07	50.98
April.....	.....	.....	.....	92.75	90.90	91.16	126.25	124.55	124.76	50.12	42.49	46.08
May.....	85.11	84.30	84.73	101.00	90.99	92.71	138.20	124.60	126.30	51.90	47.56	50.91
June.....	85.30	84.57	84.78	99.95	92.08	92.93	136.90	125.60	126.47	54.22	50.74	52.83
The year.....	85.30	84.30	84.76	103.80	90.90	92.80	141.90	124.55	126.44	54.22	42.49	50.46

¹ Rod raised 0.31 Aug. 2; heights corrected for July.
² Two months.

³ Eight months.
⁴ Lake filled in October, 8 months.

TABLE NO. 11.—*Principal freshets of year 1913-14.*

Date of beginning.	Vigia.		Alhajucla.			
	Eleva- tion of crest.	Rise.	Eleva- tion of crest.	Rise.	Hours after Vigia.	Maxi- mum dis- charge.
1913.	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Cubic feet per sec.</i>
Sept. 9.....	136.2	10.0	99.6	6.8	1½	20,000
Nov. 8.....	137.3	9.1	100.3	6.0	1½	21,200
Nov. 10.....	141.9	13.9	103.8	9.7	2	34,000
Nov. 12.....	137.4	8.4	100.7	5.9	1	22,600
Nov. 18.....	138.0	9.2	101.1	6.6	1	24,000
1914.						
May 21.....	138.2	11.7	101.0	7.9	1	23,680

Date of beginning.	Gamboa.					
	Eleva- tion of crest.	Rise.	Hours after Vigia.	Per cent of Vigia rise.	Per cent of Alhajucla rise.	Maxi- mum dis- charge.
1913.	<i>Feet.</i>	<i>Feet.</i>				<i>Cubic feet per sec.</i>
Sept. 9.....	62.65	0.64	3½	6.4	9.4	(1)
Nov. 8.....	74.60	.59	2½	6.5	9.7	(1)
Nov. 10.....	76.20	.85	8	6.1	8.8	(1)
Nov. 12.....	76.79	.24	5½	2.9	4.1	(1)
Nov. 18.....	78.86	.30	3½	3.3	4.5	(1)
1914.						
May 21.....	84.62	.13	2½	1.1	1.6	(1)

Date.	Gatun.					
	Eleva- tion 24 hours after Gamboa crest.	Rise 24 hours after Gamboa crest.	Maxi- mum in 24 hours.	Maxi- mum storage in 24 hours.	Maxi- mum dis- charge in 24 hours.	Yield of water- shed in 24 hours.
1913.	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Sec. feet.</i>	<i>Sec. feet.</i>	<i>Sec. feet.</i>
Sept. 10.....	62.56	0.37	0.39	14,940	(²)	14,940
Nov. 9.....	75.05	.59	1.08	48,950	.....	48,950
Nov. 11.....	76.51	.50	.94	43,170	.....	43,170
Nov. 13.....	77.21	.44	.46	21,410	.....	21,410
Nov. 19.....	79.28	.49	.50	24,310	.....	24,310
1914.						
May 22.....	85.04	.47	.47	24,420	.....	24,420

¹ 13,000 affected by backwater from Gatun Lake.² Gates closed.

Excess rise at Gatun May 22 due to continued rains on lake and second small rise on Chagres.

TABLE NO. 12.—Data on slopes of Chagres River and Gatun Lake during freshet period of Nov. 10-11, 1913.

Station.	Miles from Gatun.	Elevations at various stations when crest was at—				Elevation 24 hours after Gamboa crest.	Elevations 48 hours after Gamboa crest.	Maximum elevations, stations above Gamboa.
		Low water.	Vigia, 2 p. m.	Alhajuela, 4 p. m.	Gamboa, 10 p. m.			
Vigia.....	45.75	125.0	141.90	141.70	133.85	129.80	132.19	141.90
Calle Larga (Alhajuela gauging station).....	40							112.2
Alhajuela.....	38.5	91.0	102.50	103.80	99.75	95.60	97.65	103.8
Juan Mina.....	34			79.1				80.6
Gamboa.....	27.75		75.65	75.85	76.20	76.43	76.89	
San Pablo.....	20.25		75.59	75.72	75.98	76.44	76.85	
Frijoles.....	12.10		75.59	75.70	75.99	76.44	76.86	
Bohio.....	10.0		75.60	75.71	76.00	76.49	77.91	
Gatun.....	0		75.61	75.72	76.01	76.51	76.90	

TABLE NO. 13.—Data on slopes of Chagres River and Gatun Lake during the freshet period of May 21-22, 1914.

Station.	Miles from Gatun.	Elevation at various stations when crest was at—					Elevation 24 hours after Gamboa crest.	Elevation 48 hours after Gamboa crest.	Maximum elevations, stations above Gamboa.
		Low water.	Vigia, 9 p. m.	Alhajuela, 10 p. m.	Juan Mina, 11 p. m.	Gamboa, 11.30 p. m.			
Vigia.....	45.75	125	138.20	137.00	135.20	134.20	128.65	128.45	138.20
Calle Larga (Alhajuela gauging station).....	40			106.3					106.30
Alhajuela.....	38.5	91	99.40	101.00	100.35	99.80	94.65	94.35	101.00
Juan Mina.....	34		84.70	84.98	85.09	85.08	¹ 85.10	84.90	85.09
Gamboa.....	27.75		84.51	84.55	84.62	84.62	¹ 85.01	84.92	84.62
San Pablo.....	20.25		84.52	84.52	84.56	84.56	¹ 85.05	84.95	
Frijoles.....	12.10		84.52	84.51	84.55	84.57	¹ 85.03	84.97	
Bohio.....	10.0		84.55	84.56	84.57	84.58	¹ 85.04	85.00	
Gatun.....	0		84.55	84.55	84.56	84.57	¹ 85.01	84.97	

¹ Excess rise on lake due to several small rises on Chagres and continued heavy rains over lake area.

Respectfully,

F. D. WILLSON,
Chief Hydrographer.

Col. H. F. HODGES, United States Army,
Engineer of Maintenance, Culebra, Canal Zone.

APPENDIX B.

REPORT OF THE ENGINEER OF TERMINAL CONSTRUCTION, DEPARTMENT OF OPERATION AND MAINTENANCE.

CULEBRA, CANAL ZONE, *August 1, 1914.*

SIR: I have the honor to submit the following report of work performed by the division of terminal construction during the fiscal year ended June 30, 1914.

ORGANIZATION.

This division was established by Circular No. 660-1, dated April 1, 1914, reading as follows:

(a) The division of terminal construction, under the supervision of an engineer of terminal construction reporting to the governor. This division will embrace the forces of the second division, chief engineer's office, engaged in the design, inspection, and construction of dry dock, shops, coaling and fuel-oil plants, floating cranes, docks, and other terminal facilities, construction transportation by rail and water (not including dredging work), the road, street, and sewer work under the landscape architect, and breakwater construction at the Atlantic terminal.

Effective August 1, 1913, the subdivision of Balboa town-site work was organized with Mr. W. L. Phillips, landscape architect, in local charge, for work in connection with laying out and constructing the street, water, and sewer systems and grounds of Balboa town-site.

On October 10, 1913, upon the abolishing of the central division, the transportation forces of that division, as well as the transportation forces of the first division, the fifth division, and the fortifications division on the Pacific side, were transferred to this division, under the immediate supervision of Mr. W. J. Holmes, as superintendent of railroad transportation. Effective June 16, 1914, all railroad transportation under the supervision of the division of terminal construction was transferred to the Panama Railroad in local charge of Mr. F. R. Blunt, as superintendent of railroad transportation.

On January 1, 1914, the steam shovels, air drills, equipment, and personnel of the fourth division on Sosa Hill, as well as the tracks of Sosa Hill quarry, were transferred to this division.

Effective February 1, 1914, the Atlantic division was abolished and the breakwater work and operation of Porto Bello quarry was transferred to this division.

Effective June 1, 1914, the operation of Ancon quarry was transferred from the general construction division to this division.

Since June 3, 1914, the engineer of docks in charge of the design and construction of all Panama Railroad docks and piers has reported to the engineer of terminal construction. The report of the engineer

of docks on this work is covered in the annual report of the Panama Railroad Co.

On June 16, 1914, the Miraflores sand service was transferred from the general construction division to the division of terminal construction.

GENERAL.

The work under the division of terminal construction is being executed by the following organization:

(a) A central drafting, designing, and inspection office at Culebra, and a branch drafting office at Corozal.

(b) Pacific terminals subdivision, charged with the construction of shops, dry docks, coaling plant, and piers, and the handling of the rock and sand service.

(c) A subdivision in charge of Balboa town-site work, Pacific terminals.

(d) A subdivision in charge of the construction of the Cristobal coaling plant, Atlantic terminals.

(e) A subdivision in charge of breakwater construction, Atlantic terminals.

The annual reports for 1912 and 1913 give a general description of the work included in "Terminal construction."

DESIGN, DRAFTING, AND INSPECTION.

Permanent shops.—Lieut. Col. T. C. Dickson, Ordnance Department, United States Army, as inspector of shops, was in immediate charge of the designing and the supervision of the construction, installation of machinery, etc., until March 6, 1914, when he was, by direction of the Secretary of War, assigned to duty in the United States under the Ordnance Department. From March 7, 1914, to June 30, 1914, his duties in connection with the permanent shops have been performed by Mechanical Engineer A. L. Bell. Assistant Engineer G. I. Finley was transferred to the United States on May 3, 1914, in connection with the inspection of movable metal louvers, steel rolling doors, and steel work for quay walls.

Mr. C. A. Johnson, who was in immediate charge under Col. Dickson of work connected with the design of the power layout for the shop buildings, resigned on September 12, 1913, on the practical completion of his work; and Mr. H. F. Whiting, in immediate charge under Col. Dickson of the design of the illuminating system for the shop buildings, resigned on March 7, 1914, on the completion of his work. Mr. A. L. Prather performed the duties of field inspector during the entire year.

During the year 442 tracings were completed, including 82 tracings covering the motorization of 70 machines.

The designing work accomplished and the tracings approved during the year include details of foundations, walls, windows, doors, steel rolling doors, movable and fixed louvers, etc., for inclosing the buildings; the floor plans of the shops' office building; roof-drainage system; piping system for water, steam, compressed air, fuel oil, and sewage; layout of conduits, etc., for electric power and lighting systems; foundations for machines, etc.; details for applying motors to machines; stringers, shafting, etc., for groups of machines driven by motors; work benches and tables, wire-screen partitions for office and tool rooms; illumination system; distribution of power to motors and location of control apparatus.

In addition to the regular design work in connection with the permanent shop buildings, this office prepared blue prints for the

installation of machines for the dredging division in the old Paraiso shops, and for the layout of machines in the engine house erected at Gold Hill to care for the hostling of engines engaged in excavation on the east bank of the canal opposite Culebra.

The force of engineers, draftsmen, and assistants at the close of the year numbered 10. The maximum number of men employed was 23, in September, 1913, and the minimum number, 10, in June, 1914.

Steelwork.—The steelwork for the buildings, contract for which was awarded to the United States Steel Products Co., on Washington Order 35041, was completely erected, with the exception of toilet buildings Nos. 24 and 25, and the crane runway extensions at the north end of building No. 1. The amount of steel in each building, the date of acceptance of the building, and the cost of the steelwork is shown on Table No. 1, attached.

Contract for structural steel for the shops' office building was awarded to the Riter-Conley Co., on Washington Order 40894, and erection was completed by the contractor on May 29, 1914. Forces of the supply department will complete the remaining construction of the building. The total weight of this structure was 719,529 pounds, and the price, erected, \$29,959.43.

Closures.—With few exceptions, the type of closure for the various buildings has been finally determined. In general, buildings used as offices, storehouses, or shops which must be protected from dampness, have their walls built of hollow vitrified tile blocks, or hollow cement tile blocks, plastered inside and out with cement mortar. These buildings are fitted with wooden swing doors, and with glazed sash in all other openings.

The main shop buildings will have sides and a portion of the ends closed with movable metal louvers. Steel rolling doors have been fitted at the ends of the buildings, to permit overhead traveling cranes to run out over tracks at each end, and along the east and west center lines, where the through track is located, as well as at points where a considerable quantity of work must be handled from outside of the building. These buildings have the space between the roof of the lean-tos and the overhanging shed brackets, and the space between overhanging shed brackets (on the west sides of buildings Nos. 1 and 2) closed with glazed window sash. The sides of the monitors will be closed with fixed wooden louvers. The gable ends of the buildings, the ends of lean-to above the lower chord of the truss, and the ends of monitors, as well as the space between the tile roofs and the bottom of sash frames will be closed with expanded metal plastered with cement mortar.

Contracts for the closure of the buildings have been made as follows: With the Jas. G. Wilson Manufacturing Co. on Washington Orders Nos. 42141, 43691, and 51213, for steel rolling doors, shown in detail as follows:

Washington Order 42141:

12 doors north and south ends of building No. 1.....	\$11, 184. 00
6 doors north and south ends of building No. 2.....	5, 592. 00
6 doors north and south ends of building No. 4.....	5, 592. 00
6 doors east and west ends of building No. 12.....	5, 592. 00

Grand total.....	27, 960. 00
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Washington Order 43691:

6 doors for ends of building No. 3.....	\$8, 190. 00
34 doors for sides of building No. 3.....	8, 752. 00
Grand total.....	<u>16, 942. 00</u>

Washington Order 51213:

11 doors for sides of building No. 1.....	6, 982. 80
6 doors for ends of building No. 7.....	3, 805. 98
15 doors for north side of building No. 7.....	8, 400. 00
2 doors for ends of building No. 8.....	1, 153. 00
4 doors for sides of building No. 8.....	2, 329. 60
1 door for east end of building No. 12.....	896. 00
Grand total.....	<u>23, 567. 38</u>

With the Mesker Bros. Iron Works on Washington Order 50923 for movable metal louvers, shown in detail as follows:

Washington Order 50923, 50,000 square feet movable metal louvers for buildings Nos. 1, 2, 4, 8, 12, 14, 15.....	\$54, 500
Erected in place in buildings.	

Fixed wood louvers, sash, and wooden swing doors are being manufactured by the mechanical division and installed as rapidly as possible.

Roofing.—The cement tile roofing gives evidence of being satisfactory. At the present time, however, maintenance of the roofing is expensive, on account of the large amount of work being done in connection with the closure of the buildings and the consequent travel over the tile by workmen, and also due to breaking of the tile by rocks thrown on the roofs by blasting in the dry-dock excavation. The American Cement Tile Manufacturing Co. completed the manufacture and erection of the reinforced cement tile supplied by them for the roofs of the shop buildings, and the amount manufactured, the unit price, and the total price are shown by buildings in Table No. 2, attached. This table also shows the amount of tile manufactured for other purposes.

Building No. 11 and building No. 15 were covered with Barrett specification roofing, as were the valleys of buildings Nos. 1, 7, 8, and 10. The total amount placed is shown in Table No. 3, attached.

Power and lighting distribution.—The details of the power and lighting installation were practically completed during the year and requisitions placed for the necessary material.

The general arrangement of power and lighting distribution adopted was to locate transformer rooms at load centers in the shops, carry power to them from the substation at 2,300 volts, and step it down to 230 volts for local requirements.

The more important equipment installed is as follows:

Principal centers:

Building No. 1—

- Two 300 K. V. A. 3-phase power transformers.
- One 140 K. W. single-phase lighting transformer.
- Two 325 K. W. motor generator sets.
- One 7-panel switchboard.

Building No. 3—

- Two 300 K. V. A. power transformers.
- One 125 K. W. single-phase lighting transformer.
- One 3-panel switchboard.

Principal centers—Continued.**Building No. 8—**

- Two 300 K. V. A. 3-phase power transformers.
- One 50 K. W. single-phase lighting transformer.
- One 3-panel switchboard.

Building No. 12—

- Two 300 K. V. A. 3-phase power transformers.
- One 60 K. W. single-phase lighting transformer.
- One 3-panel switchboard.

Minor centers:

Building No. 7, 50 K. V. A. single-phase lighting transformer.

Building No. 9, 75 K. V. A. 3-phase power transformer, with neutral tap from one phase for lighting.

Building No. 15—

- One 15 K. V. A. single-phase lighting transformer.
- One 75 K. V. A. 3-phase power transformer.
- One 1-panel switchboard.

Building No. 28, one 50 K. V. A. single-phase lighting transformer.

In addition to the above other buildings are equipped with switchboards for local control of power and lighting.

Power and lighting feeders are carried to transformer rooms and switchboards through ducts laid in the walls of the tunnel which runs under the east and west center line of the main buildings. Inside the buildings all wires and cables are carried in galvanized iron conduit, which is hung on steel work of the building above the lower chords of the roof trusses and brought down the columns to controllers, panel boxes, etc.

The central switchboards, on account of limited space, were not designed to permit control of all power and lighting circuits at the board and junction boxes were therefore resorted to. The feeders for sections of each shop run to junction or fuse panels from which the power and lighting circuits for the section are distributed.

The main distributing centers in buildings Nos. 1 and 8 deliver the greater portion of their power to the buildings in which they are located. The transformers in building No. 3 supply buildings Nos. 2 and 4 also, while those in building No. 12 supply buildings Nos. 7, 9, 10, and 15.

Motors.—Four types of motors were adopted for power drives—direct current, commutating pole variable speed motors; slip-ring induction motors; squirrel-cage induction motors; and synchronous motors. Direct current motors operate on 220-volt current, and alternating current motors on 220-volt, 3-phase, 25-cycle current.

The direct-current motors drive lathes, planers, boring machines, milling machines, and other tools where a variable tool speed is desired. They have speed ranges from 350 to 1,400; 375 to 1,125; 375 to 1,500; 450 to 1,800; 500 to 1,500.

The slip-ring, polar-wound, rotor induction motors drive machines requiring a high starting torque or that are necessarily reversible, e. g., bending rolls, low-pressure blowers, the 2-ton tropenas converter, and the transfer table.

The squirrel cage induction motors are used for all group drives and on all constant speed machines.

The synchronous motors are used for driving direct current generators and air compressors, and are arranged for operation at 75 per cent leading power for correcting the load factor of the plant.

All motors were purchased under specifications calling for specially developed insulation similar to that used on the lock-machinery motors.

The attached table, No. 4, shows the rated horsepower of all motors in each group and building for driving cranes, individual machines, and groups of machines.

Lighting for the shops is obtained from Tungsten filament lamps, general illumination is used, and 220-volt, single-phase, 25-cycle lamps are so placed that all points in the building receive approximately the same illumination. This system makes changes in wiring and relocation of lamps unnecessary when changes are made in the location of machines. Branch lighting circuits are controlled from panel boxes and panel boards. All branch circuits are designed for a maximum load of 3,000 watts with a drop of 3 volts.

The lamps have been equipped with various types of Holophane D'Olier reflectors, depending on their location and the distribution of light desired. They are carried on the under sides of roof trusses and on columns around the sides of the buildings.

The attached table, No. 5, shows the number, size, and location of lights installed in the various shops, and the attached table, No. 6, shows the floor space, watts, foot candles, and lumens in each building. The plane of illumination is taken 3 feet above floor.

All the equipment required for illumination of the shop buildings has been ordered and received on the Isthmus.

The attached table, No. 7, shows the progress of installation of light and power distribution systems, and of electrical work on motorization of machines, by buildings.

The installation of light and power cable in the shop tunnel has been delayed, owing to the change in the location of the substation, which has made necessary the redesigning of the distributing system.

Foundations.—Work on the foundations for the machinery in the shop buildings was under way in building No. 8 at the beginning of the fiscal year, and work on the foundations for this building and for building No. 12, as well as the details of motor drives and the general layout of machines, was hastened on account of the necessity of moving the planing mill and the foundry from the Gorgona shops of the mechanical division to these buildings. The planing mill commenced operations on July 29, 1913, and the foundry on August 14.

Work on foundations for machines on the remaining buildings was completed during the year, with the exception of a small amount of foundation work required for the installation of jib cranes and equipment which was not originally contemplated. In designing the foundations for these machines the type of machine had to be taken into consideration, as well as the nature of the ground on which the foundation was to be carried.

The three types of foundation adopted were as follows:

In the north end of building No. 1 heavy machines were supported by steel caissons sunk to bedrock and filled with concrete.

In the north end of buildings Nos. 1, 2, and 4, and under foundations for the large furnaces in building No. 12, foundations were supported by pipe piling driven to bedrock, this pipe being standard 10 or 12 inches, filled with concrete, and reinforced with bars. Foundations for heavy machines in other parts of the buildings,

where rock was reasonably near the surface, were carried down to rock. For the light machines a spread foundation was used and excavation carried only deep enough to reach firm ground.

Flooring.—Types of flooring adopted vary with the requirements of the different shop buildings, and are outlined below:

For all tool rooms creosoted wood blocks were laid on a concrete foundation. For the foreman's office tongue and grooved yellow pine flooring was laid on top of 2-inch planking, spiked to stringers bedded in a concrete foundation. For the machine shop (building No. 1), the tin shop (building No. 2), and the planing mill (building No. 8), creosoted wood blocks were laid on a concrete base. For the forge shop and the boiler shop (buildings Nos. 2 and 4), and the roundhouse (building No. 15), cinders were used. For the storehouse (building No. 5), the paint shop (building No. 6), and the plating and polishing and the grinding and buffing rooms in building No. 9, concrete was adopted. This type of floor was also used in the oxy-acetylene plant (building No. 16), and toilet (buildings Nos. 17 to 25), inclusive. A clay floor was put in the foundry (building No. 12).

INSTALLATION OF MECHANICAL DIVISION AND SHOPS.

The mechanical division abandoned Gorgona shops early in the fiscal year, and transferred direct to Balboa, the foundry in August, 1913, and the planing mill in July, 1913. The other shops were transferred to Empire temporarily and commencing March 1, 1914, were gradually moved to Balboa. At the close of the fiscal year practically all machines were erected in their permanent locations and in operation. A few machines in use by other divisions which are not available for transfer at the present time remain to be installed.

Shops office.—The completion of the shops office (building No. 28), with the exception of steel framework, which is already erected, and the cement tile roofing, which will be applied by the mechanical division, has been turned over to the supply department.

Although very little work has been done on the design of the additional buildings, there will be required, in addition to the 28 outlined in the annual report for the year 1912-13, building No. 29 to house air compressors for the shops and pumps for the dry dock, and building No. 30, potash-vat house.

The attached table, No. 8, gives the floor area of the various buildings and shops that have been authorized to date.

Contracts.—Contracts for equipment for the Balboa shops were made during the year, as shown in the attached table, No. 9.

Equipment installed.—As the greater portion of equipment installed in the Balboa shops has been in service on the Isthmus for a number of years, and as there were available a number of 25-cycle motors which could be used for motorization of similar machines, there has been prepared the attached table, No. 10, which shows the number of new and old machines, motors, and traveling cranes installed in the various buildings.

Surface drainage.—The elevation adopted for the shop yard was 18 feet above sea level. The greater portion of the original surface was from 2 to 6 or 8 feet below this. The yard is being brought up to grade by dumping spoil in the lower sections and applying a

surface of crushed rock covered with screenings. This arrangement affords an opportunity for rain water to drain off, which has made unnecessary the installation of an extended system of drainage in the open portions of the yard. Around the shops buildings trenches have been dug under the eaves in which "blind" tile drains have been laid and covered with crushed rock with no surface screenings. The water rapidly settles through the crushed stone, and the drainage thus far has been very satisfactory. At the present time the drains discharge into the dry-dock excavation, at the south, and back of the quay wall, on the north. Eventually it is intended to place a sewer at the ends of the drains running south, which will discharge into the harbor.

Piping.—The installation of air, oil, steam, water, and sewer piping in the shop tunnel and in all shop buildings was practically completed during the year. Permanent connections for air, oil, steam, and water can not be made, however, until the completion of the dry-dock excavation and the subsequent filling of the present incline and the construction of the permanent air-compressor plant. In the shop toilets construction work has been held up due to the nondelivery of urinals, closets, washbasins, etc., by contractors. The buildings are ready for the installation of this equipment when it is received.

TABLE NO. 1.—*Showing weight of steel, date of acceptance, and contract payments—Balboa shop buildings.*

Building No.	Total steel erected.	Date of acceptance.	Total contract price.
	<i>Pounds.</i>		
1 and XI.....	1,840,661	Feb. 21, 1914	\$70,844.43
X2.....	28,631	do.....	
2.....	813,844	Feb. 25, 1914	29,953.72
3.....	583,528	Jan. 24, 1914	20,993.64
4.....	1,121,964	Feb. 14, 1914	40,536.98
5.....	2,337,290	Feb. 10, 1914	86,459.33
5X1.....	92,975	do.....	
6.....	197,071	Feb. 22, 1914	7,903.57
7.....	627,935	Feb. 24, 1914	22,389.88
8.....	829,332	do.....	29,855.91
9.....	142,033	Feb. 11, 1914	5,371.03
10.....	1,093,399	Feb. 21, 1914	38,932.88
11.....	244,576	June 26, 1913	8,560.16
12.....	1,090,584	Jan. 10, 1914	38,821.19
13.....	61,277	Dec. 3, 1913	2,185.82
14 ¹			2,545.34
15.....	315,267	Jan. 23, 1914	11,034.34
16.....	19,688	Mar. 5, 1913	700.65
17, 18.....	42,834	Oct. 27, 1913	1,534.32
19, 20.....	32,932	Oct. 29, 1913	1,179.70
21, 22, 23.....	94,757	{.....do..... do..... Nov. 5, 1913}	3,394.14
24, 25 ¹			1,185.86
26.....	17,355	Nov. 12, 1913	720.14
27.....	29,496	Dec. 31, 1913	2,049.97
Total.....	11,657,429	.....	427,203.00

¹ Erected by commission.

TABLE NO. 2.—Statement of the total amount of tile erected on the permanent shop buildings.

Building No.	Standard red tile squares, at \$13.25 per square.	Gutter tile squares, at \$14.25 per square.	Ridge roll (linear feet), at 55 cents per linear foot.	Ribbed glass pieces, at 93 cents each.	Total cost.
1.....	\$995.08	\$57.90	\$1,375.50	2,875	\$17,440.17
2.....	527.10	.....	378.00	962	8,086.64
3.....	361.79	.....	377.40	350	5,326.79
4.....	659.29	.....	377.40	1,660	10,486.96
5.....	676.05	.....	701.67	988	10,262.42
6.....	147.33	.....	258.34	244	2,321.13
7.....	535.00	36.20	670.00	1,530	9,396.00
8.....	711.53	45.40	838.00	1,586	12,010.60
9.....	109.50	.....	164.00	.....	1,541.08
10.....	898.13	61.65	1,133.30	.....	13,402.04
12.....	581.84	.....	335.00	875	8,707.38
13.....	49.93	.....	180.50	.....	760.85
16.....	11.96	.....	47.00	.....	184.32
17, 18.....	37.80	.....	104.00	24	580.36
19, 20.....	26.30	.....	72.00	16	402.96
21, 22, 23.....	88.60	.....	255.00	60	1,370.00
26.....	15.90	.....	52.00	12	250.44
27.....	8.05	.....	32.00	6	129.84
Total.....	6,441.18	201.15	7,351.11	11,188	102,659.98

TABLE NO. 2.—Statement of the total amount of roof tile manufactured by the American Cement Tile Co.

Item.	Standard, special and glass tile.		Gutter tile.		Ridge roll.		Ribbed glass.		Total cost.
	Number of squares.	Price per square.	Number of squares.	Price per square.	Number of linear feet.	Price per linear foot.	Pieces.	Price per glass.	
Erected on permanent shop buildings at Balboa.....	6,441.18	\$13.25	201.15	\$14.25	7,351.11	\$0.55	11,188	\$0.93	\$102,659.98
Panama Railroad passenger station.....	123.00	10.25	.....	.....	463.00	.55	.....	.....	1,515.40
Pier shed.....	1,636.54	9.225	238.70	10.125	3,576.00	.495	.....	.....	19,284.04
Fortifications.....	.....	.....	36.75	10.125	.....	.....	.....	.....	372.09
Buildings to be erected and stock for repairs ¹	767.72	10.25	.....	.....	1,724.00	.55	2,712	.837	11,087.27
Breakage assumed by The Panama Canal.....	12.08	10.25	.....	.....	12.00	.55	30 77	.93 .837	222.77
Grand total.....	8,980.52	.....	476.60	.....	13,126.11	.....	14,007	.....	135,141.55

¹ Includes buildings Nos. 14, 24, 25, 28, 29, 30.

TABLE NO. 3.—Statement of the total amount of Barrett specification roofing erected in permanent shop buildings.

Building No.—	Squares.
1.....	60.83
7.....	35.01
8.....	45.40
10.....	61.55
11.....	84.66
15.....	312.00
Total.....	599.45

NOTE.—One square equals 100 square feet.

TABLE NO. 4.—Showing horsepower of motors and their distribution in Balboa shop buildings.

Circuit.	Building No.	Cranes (horse-power).	Alternating current.				Direct current (individual).		Total alternating current horse-power.
			Groups.		Individual.				
			Num-ber.	Total horse-power.	Num-ber.	Total horse-power.	Num-ber.	Horse-power.	
1.....	1	347½	21	265	18	143	29	361½	755½
2.....	2	67½	2	40	7	127½			
	3	83			4	30			
	4	202½	2	30	22	218			
	16		1	7½					
		353	5	77½	33	375½			806
3.....	8		7	92½	30	639			
	5				2	60			
	28				2	5½			
			7	92½	34	704½			796½
4.....	12	193	2	15	16	206½			
	10				3	15			
	7		1	7½	3	35			
		193	3	22½	22	256½			472
Extension of 4...	15		1	10	1	15			
	9	25½	1	7½	6	37			
		25½	2	17½	7	52			95
Air compressor..					5	2,000			2,000
Total.....								361½	4,910½

TABLE NO. 5.—Showing number and size of lights in Balboa shop buildings.

	Lights.	Location.
Building No. 1:		
500 watt.....	92	High-section truss.
250 watt.....	96	Lean-to and saw-tooth truss.
250 watt.....	17	Between main columns next lean-to.
250 watt.....	34	Between main columns next saw tooth.
250 watt.....	22	Crane girders, tool room.
250 watt.....	54	Columns, high-section.
250 watt.....	12	Between columns section, west side.
250 watt.....	16	Lean-to columns.
250 watt.....	17	Between lean-to columns.
250 watt.....	4	Transfer pit.
250 watt.....	11	End trusses.
150 watt.....	42	Tool shop.
100 watt.....	6	Low ceiling, repair rooms.
100 watt.....	56	Bench lights.
100 watt.....	4	Offices.
70 plug receptacles.		
Building No. 2:		
500 watt.....	32	High-section truss.
250 watt.....	42	Lean-to truss.
250 watt.....	16	Main columns, next lean-to.
250 watt.....	6	End trusses.
100 watt.....	2	Offices.
100 watt.....	16	Bench lights.
24 plug receptacles, 2 panel switch-boards.		
Building No. 3:		
500 watt.....	19	Center truss.
250 watt.....	10	Crane extensions.
100 watt.....	2	Transformer room.
250 watt.....	4	Columns between racks.
13 plug receptacles.		
Building No. 4:		
500 watt.....	48	Center truss.
250 watt.....	120	Lean-to truss.
250 watt.....	32	Main columns.
250 watt.....	16	Side columns.
250 watt.....	10	End trusses.
100 watt.....	2	Offices.
100 watt.....	19	Bench lights.
27 plug receptacles, 2 panel switch-boards.		
Building No. 5:		
100 watt.....	120	Ceiling, first floor.
100 watt.....	125	Trusses, second floor.

TABLE NO. 5.—*Showing number and size of lights in Balboa shop buildings—Continued.*

	Lights.	Location.
Building No. 6:		
150 watt.....	24	Center line building between trusses.
150 watt.....	33	Eave strut, south side and north side.
150 watt.....	14	Eave strut, north side, east half.
100 watt.....	1	Office.
5 plug receptacles, 14 heater receptacles.		
Building No. 7:		
500 watt.....	28	Center line of trusses, high section.
150 watt.....	28	Bottom of lattice truss.
150 watt.....	60	Eave strut between trusses.
150 watt.....	8	Bottom chord, end trusses.
150 watt.....	4	Sides of office, outside.
60 watt.....	4	Tool room.
60 watt.....	3	Office, inside.
23 plug receptacles, 3 snap switches.		
Building No. 8:		
250 watt.....	144	Lower chord, main trusses.
250 watt.....	24	Lower chords, dropped below shafting.
250 watt.....	30	Lower chords, dropped below knee brace.
250 watt.....	24	Bench lights.
100 watt.....	2	Office.
100 watt.....	6	Tool room.
20 plug receptacles.		
Building No. 9:		
250 watt.....	14	Underside trusses.
250 watt.....	4	End trusses, galv. room.
4 plug receptacles.		
Building No. 10:		
250 watt.....	18	Lower chords, roof trusses.
250 watt.....	2	On braced struts at dry room.
60 watt.....	4	Foundry supply room ceiling.
60 watt.....	4	Dry room ceiling.
4 plug receptacles, 5 snap switches.		
Building No. 11:		
100 watt.....	30	Ceiling and roof beams.
39 plug receptacles.		
Building No. 12:		
500 watt.....	31	Center truss.
250 watt.....	23	Lean-to truss.
100 watt.....	4	Lean-to truss, charging floor and blower room.
100 watt.....	2	Between furnace and oven.
250 watt.....	33	Face main columns.
250 watt.....	6	End trusses.
100 watt.....	2	Office.
250 watt.....	12	Over crane runway lean-to.
100 watt.....	4	Sandblast room, special.
100 watt.....	10	Bench lights.
100 watt.....	1	Outside blower room.
19 plug receptacles.		
Building No. 13, none.		
Building No. 14:		
250 watt.....	7	Lower chord trusses.
250 watt.....	3	End and side of strut.
Building No. 15:		
250 watt.....	48	Roof beams, roundhouse.
150 watt.....	12	Roof beams, machinery room.
60 watt.....	6	Office and tool room.
33 plug receptacles.		
Building No. 16:		
100 watt.....	6	Roof trusses.
100 watt.....	1	Oxygen room.
6 plug receptacles.		
Buildings Nos. 17 and 18 (each):		
60 watt.....	8	On wood stringers between trusses.
1 snap switch.		
Buildings Nos. 19 and 20 (each):		
60 watt.....	4	Do.
1 snap switch.		
Buildings Nos. 21, 22, 23 (each):		
60 watt.....	12	Do.
2 snap switches.		
Buildings Nos. 24 and 25 (each):		
60 watt.....	8	Do.
2 snap switches.		
Building No. 28, first and second floors (each):		
100 watt.....	86	Ceilings, offices, vaults, etc.
60 watt.....	4	Toilets, general.
60 watt (4 first floor, 2 second floor).....		Private toilets, closets, etc.
60 watt, third floor.....	5	Porch ceilings.
100 watt.....	82	Ceilings, offices, closets, etc.
60 watt.....	4	Toilets, general.
60 watt.....	2	Toilets, private.
60 watt.....	6	Porch ceilings.

TABLE NO. 6.—Showing calculated illumination in Balboa shop buildings.

Building No.	Purpose.	Dimensions.	Floor space.	Watts.	Watts per square foot.	Foot candles.	Lumens per watt.
1.....	Machine shop.....	130' 6" by 353' 8".....	46, 806	79, 100	1. 69	7. 60	4. 49
	Tool department.....	58' 6" by 104' 6½".....	6, 174	13, 825	2. 24	8. 37	3. 74
	Erecting shop.....	58' 6" by 253' 1½".....	14, 808	27, 500	1. 85	7. 75	4. 20
2.....	Forge shop.....	89' 1" by 179' 2½".....	15, 964	12, 500	. 78	2. 80	3. 60
	Pipe, tin, and copper shop.	89' 1" by 179' 2½".....	15, 964	16, 750	1. 05	4. 50	4. 30
3.....	Machine shop.....	50' 4" by 84' 10".....	4, 270	6, 000	1. 41	6. 20	4. 42
	Steel storage.....	50' 4" by 274' 7".....	13, 821	5, 000	. 36	1. 50	4. 17
4.....	Boiler shop.....	129' 0" by 358' 8".....	46, 268	68, 400	1. 48	6. 10	4. 12
5.....	General storage:						
	First floor.....	118' 8" by 400' 3".....	47, 496	12, 000	. 25	1. 30	5. 20
	Second floor.....		46, 734	12, 600	. 26	1. 30	5. 00
6.....	Paint shop.....	49' 8½" by 252' 11½".....	12, 570	10, 750	. 86	3. 99	4. 65
7.....	Car shop.....	122' 4" by 317' 1".....	38, 790	29, 000	. 76	4. 02	5. 33
8.....	Planing mill.....	121' 4" by 400' 5".....	48, 580	56, 000	1. 15	6. 67	5. 80
	Galvanizing plant:						
9.....	Plating and grinding room.	39' 4½" by 61' 3".....	2, 412	2, 000	. 83	3. 48	4. 19
	Galvanizing room..	39' 4½" by 86' 8".....	3, 413	2, 500	. 73	2. 85	3. 80
10.....	Lumber and equipment shed.	122' 4" by 549' 0".....	67, 160	5, 000	. 08	. 31	3. 88
11.....	Pattern storage:						
	First floor.....	58' 8" by 119' 10".....	7, 030	1, 500	. 21	. 90	4. 29
	Second floor.....	58' 8" by 119' 10".....	6, 973	1, 500	. 21	. 90	4. 29
12.....	Foundry:						
	Main molding floor.	61' 2" by 316' 6".....	19, 360	22, 000	1. 14	4. 63	4. 10
	Brass molding floor and core room.	28' 5" by 136' 9".....	3, 886	4, 250	1. 1	3. 01	2. 74
	Chipping and cleaning room.	28' 5" by 179' 9".....	5, 108	3, 250	. 64	2. 48	3. 90
	Supply bins, etc...	28' 5" by 316' 6".....	8, 994	3, 850	. 43	1. 80	4. 20
13.....	Coke shed.....	18' 6" by 167' 10".....	3, 104	(1)			
14.....	Boiler house.....	49' 4" by 49' 10".....	2, 460	2, 250	. 91	3. 44	3. 80
15.....	Roundhouse.....	75' 9" by 418' 5".....	2 25, 390	14, 160	. 56	3 2. 80	3 3. 00
16.....	Gas house.....	41' 1½" by 22' 0".....	904	700	. 76	3 3. 08	3 4. 00
17-25.....	Toilets.....		10, 854	4, 560	. 42	2. 19	5. 20
26.....	Paint house.....	48' 2½" by 22' 6".....	1, 085	480	. 44	2. 19	5. 20
27.....	Sand house.....	27' 0" by 19' 0".....	513	300	. 58	3 2. 03	3 3. 50
28.....	Office building.....	117' 10" by 79' 5".....	27, 624	27, 480	1. 00	5. 02	5. 02
	Grand total and averages.		554, 242	445, 205	. 80	.....	.....

1 No lights. Approximate. 3 Estimated.

TABLE NO. 7.—Showing per cent completion of electrical installations, Balboa shops buildings, on June 30, 1914.

Building No.	Power distribution.	Motorization.	Illumination.
	Per cent.	Per cent.	Per cent.
1.....	90	90	95
2.....	98	95	95
3.....	80	98	98
4.....	95	95	98
5.....			
6.....	10	90	95
7.....	10	90	95
8.....	98	98	95
9.....	80	80	80
10.....			
11.....			
12.....	40	95	50
13.....			
14.....			
15.....	90	100	95
16.....	95	95	98
17 to 23.....			95
24 and 25 1.....			
26.....			95
27.....			95
28.....			20

1 Not erected.

TABLE NO. 8.—Showing the floor area, in square feet, of the various departments of the permanent shop buildings.

	Build- ing No.	Dimensions.	Ground floor area in square feet.	Num- ber of floors.	Total floor area in square feet.
I. Shops:					
1. Tool department.....	1	58' 6" by 105' 6½".....	6,175	1	4,175
2. Erecting shop.....	1	58' 6" by 253' 1½".....	14,808	1	14,808
3. Machine shop.....	1	130' 6" by 358' 8".....	46,806	1	46,806
4. Forge shop.....	2	89' 1" by 274' 1".....	24,416	1	24,416
5. Pipe, tin, and copper shop	2	89' 1" by 84' 4".....	7,513	1	7,513
6. Boiler and shipfitter shop.	4	129' 0" by 358' 8".....	46,268	1	46,268
7. Planing mill, carpenter and pattern shop.	8	121' 4" by 400' 5".....	48,580	1	48,580
8. Foundry (brass, iron, and steel).	12	118' 0" by 316' 6", minus 4,117 for sand bins.	33,230	1	34,508
9. Paint shop.....	6	49' 8½" by 252' 11½".....	12,570	1	12,570
10. Paint mixing and storage.	26	22' 6" by 48' 2½".....	1,085	1	1,085
11. Car shop.....	7	122' 4" by 317' 1".....	38,790	1	38,790
12. Galvanizing, buffing, grinding, and plating.	9	39' 4½" by 147' 11".....	5,825	1	5,825
13. Oxy-acetylene.....	16	22' 0" by 41' 1½".....	904	1	904
II. Storehouses:					
General, first floor.....	5	118' 8" by 400' 4".....	47,496	2	94,230
Do.....	5	118' 8" by 400' 3", minus two openings 19' 3½" by 19' 9"	46,734		
2. Steel, iron, and pipe stor- age.	3	50' 4" by 359' 5".....	18,090	1	18,090
3. Lumber and equipment, foundry, supplies, and dry kilns.	10	122' 4" by 549' 0".....	67,160	1	67,160
4. Patterns.....	11	{ First floor, 58' 8" by 119' 10"..... Second floor, 58' 8" by 119' 10", minus 7' 2" by 7' 10".	{ 7,029 6,973	2	14,002
5. Coke.....	13	18' 6" by 167' 10".....	3,104		
6. Sand bins.....	12	27' 4½" by 143' 8½".....	3,934	1	3,934
III. Hostling locomotives:					
1. Roundhouse.....	15	15 stalls.....	25,390	1	25,390
2. Sand house.....	27	19' 0" by 27' 0".....	513	1	513
IV. Office.....					
	28	Each floor 50' 10" by 117' 4", and 2 wings 33' 11" by 47' 10" each.	9,208	3	27,624
V. Toilets: 1					
1. Seven toilet rooms for gold employees.	17 to 25 inc.	5 at 22' 0" by 48' ½".....	.....		5,285
		2 at 22' 0" by 23' 7½".....	.....		1,038
2. Seven toilet rooms for sil- ver employees.		5 at 22' 0" by 31' 9".....	.....		3,493
		2 at 22' 0" by 23' 7½".....	.....		1,038
VI. Power:					
1. Boiler house.....	14	49' 4" by 49' 10".....	2,460	1	2,460
2. Compressor and pump house.	29	50' by 241' and 1 wing 20' by 40' 2".	12,850	1	12,850
3. Potash vat building.....	30	20' by 20'.....			
Total.....					566,458

¹ In 9 buildings.

TABLE NO. 9.—Showing contracts placed during fiscal year for material for permanent shops.

Material.	Contractor.	Price.
Auto starters.....	General Electric Co.....	\$332.43
Induction motors, auto starters, oil switches.	do.....	24,902.50
Forging press.....	Bethlehem Steel Co.....	11,340.00
Extension planer.....	Detrick & Harvey.....	26,281.00
Locks, handles, hinges.....	Kraemer & Duhring.....	896.56
Bolts, hooks, pivots.....	Russell & Erwin Manufacturing Co.....	1,079.62
Bolts.....	Rudolph & West Co.....	92.26
Metal lath.....	Penn Metal Co.....	865.67
Woven-wire reinforcing material.....	United States Steel Products Co.....	920.38
Pipe.....	do.....	4,252.50
Turntable.....	do.....	5,411.00
Steel for pattern racks, angles, gussets.....	J. B. Kendall Co.....	3,306.00
Rivets.....	Oliver Iron & Steel Co.....	133.36
Wire-screen partition.....	Western Fence & Wire Goods Co.....	6,063.03
Clotb pinions.....	General Electric Co.....	136.00
Transformers.....	Allis-Chalmers Co.....	8,890.00
Pillar cranes.....	Whiting Foundry Equipment Co.....	3,720.00

TABLE No. 9.—*Showing contracts placed during fiscal year for material for permanent shops—Continued.*

Material.	Contractor.	Price.
Slate stalls.....	J. H. Leonard & Co.....	\$7,399.75
Steel rolling doors.....	Jas. H. Wilson Manufacturing Co.....	27,960.00
	The Casey Hedges Co.....	891.21
	Manhattan Supply Co.....	651.62
	Uniu Foundry Co.....	145.57
Pipe and fittings.....	F. N. DuBois & Co.....	229.53
	The Phillip Carey Co.....	435.23
	Akron Metallic Casket Co.....	15.24
	Nason Manufacturing Co.....	156.00
	Naylor & Co.....	6,021.00
Structural steel.....	Rhiet-Conley Manufacturing Co.....	31,959.43
	Standard Underground Co.....	507.30
Transformers and other electrical material.....	Westinghouse Electrical and Manufacturing Co.....	5,687.25
	National Electrical Supply Co.....	993.06
	Carroll Electric Co.....	4,099.95
	General Electric Co.....	24,132.19
Reinforcement, with necessary clips, shear, punch.	Penn Metal Co.....	1,400.00
Truck wheels for 2-ton crane, bushings, gears, etc.	Cleveland Crane & Engineering Co.....	160.00
Pyrometers, rivet heaters, furnaces.....	S. H. Stupakoff.....	1,153.00
	Tate, Jones Co.....	725.00
	American Shop Equipment Co.....	2,556.00
	W. S. Rockwell Co.....	13,576.00
Gasoline-burning outfit.....	The Macleod Co.....	150.00
Galvanized metal caging.....	Mitchell-Tappen Co.....	494.53
Lavatories.....	F. N. DuBois Co.....	6,351.74
	The Manhattan Supply Co.....	109.37
Steel rolling doors for side and ends of building 3.	Jas. G. Wilson Manufacturing Co.....	16,942.00
Fire doors.....	Kinnear Manufacturing Co.....	445.00
Wire mesh, galvanized woven-wire cloth.	Clinton Wire Cloth Co.....	529.54
	Crane Co.....	22.35
	Baseler & Heineker.....	462.00
Couplings, circuit boxes, pull boxes, switchboard, cable, plugs, conduit, etc.	General Electric Co.....	3,902.18
	National India Rubber Co.....	821.03
	Electrical Appliance Co.....	151.80
	National Electric Supply Co.....	489.11
	Habirshaw Wire Co.....	384.67
Ladle heater.....	Tropenas Converter Co.....	200.00
	Robinson Lumber Co.....	3,928.33
	D. L. Gillespie & Co.....	613.18
Lumber.....	J. G. Rainwater Lumber Co.....	4,053.66
	Sugar Pine Lumber Co.....	558.40
	G. Elias & Bro.....	751.76
	J. W. Hyde Co.....	584.58
Pneumatic riveter.....	Bethlehem Steel Co.....	3,300.00
Cloth pinions (13).....	General Electric Co.....	144.30
Oxy-acetylene apparatus.....	The Oxy-Acetylene Appliance Co.....	343.00
Red wood.....	Hammond Lumber Co.....	5,437.50
	W. R. Grace & Co.....	10,794.16
Railing fittings for building 5.....	Crane Co.....	121.12
Plate-lifting clamps.....	W. E. Volz.....	120.00
Cable.....	General Electric Co.....	19,732.48
6,000 feet pipe, black, 1 foot.....	Youngstown Sheet & Tube Co.....	6,060.00
	Crouse Hinds Co.....	540.10
	National Electric Supply Co.....	1,479.98
	National India Rubber Co.....	4,182.77
	General Electric Co.....	24,278.75
Transformers, switchboard, cable conduit, etc.	Crane Co.....	124.50
	F. Bissell Co.....	695.08
	Wheeler-Crocker Co.....	1,613.00
	Geo. C. Moon Co.....	660.00
	Standard Underground Cable Co.....	265.70
	Carroll Electric Co.....	181.99
	Alpha Electric Supply Co.....	398.20
Time clocks.....	International Time Record Co.....	5,076.50
Dry-kiln equipment.....	B. F. Sturtevant Co.....	3,588.20
Galvanizing furnace and pots.....	American Shop Equipment Co.....	1,549.10
Cloth pinions (21).....	General Electric Co.....	340.50
Pipe clamps.....	Jas. B. Clow & Sons.....	115.56
	General Electric Co.....	540.00
	F. Bissell & Co.....	103.50
Electrical material for building 5.....	H. Krantz Manufacturing Co.....	72.00
	National Electrical Supply Co.....	430.00
	United States Steel Products Co.....	416.53
	Westinghouse Electric & Manufacturing Co.....	412.54
Air compressors.....	Ingersoll-Rand Co.....	46,892.00
Lockers.....	Bernsteign Manufacturing Co.....	3,712.70
Swing saw.....	J. A. Fay & Egan Co.....	224.00
Electric welding outfit.....	C. & C. Electric & Manufacturing Co.....	3,500.00
Steel shafting.....	Chas. Bond Co.....	579.74

TABLE No. 9.—*Showing contracts placed during fiscal year for material for permanent shops—Continued.*

Material.	Contractor.	Price.
Vault doors.....	York Safe Co.....	\$352.00
Pulleys.....	The Fairbanks Co.....	131.43
Electrical material, panel boxes, service panels.....	Krantz Manufacturing Co.....	240.00
Channels, pipe supports.....	National Electrical Supply Co.....	1,026.87
Sandblast outfit.....	General Electric Co.....	599.40
Locks, handles, etc.....	United States Steel Products Co.....	3,761.22
	American Diamond Blast Co.....	616.00
	Rudolph & West Co.....	15.56
	Russell & Erwin Manufacturing Co.....	55.68
	Kraemer & Duehring.....	30.25
	General Electric Co.....	1,067.20
Electrical equipment.....	National Electrical Supply Co.....	734.88
	Westinghouse Electric & Manufacturing Co.....	1,975.00
	Sprague Electric Works.....	601.99
	Crane Co.....	7.65
Elevators.....	Otis Elevator Co.....	8,850.00
Cloth pinions (13).....	General Electric Co.....	277.95
Operating device for pivoted sash.....	Lord & Burnham.....	2,466.00
	General Electric Co.....	1,021.00
	Sprague Electric Works.....	268.56
Electrical material.....	National India Rubber Co.....	479.43
	Standard Underground Cable Co.....	395.75
	Western Electric Co.....	202.92
	National Electrical Supply Co.....	210.55
	Crane Co.....	20.03
Closet and urinal stalls.....	J. H. Leonard & Co.....	1,340.00
3 induction motors.....	General Electric Co.....	1,034.00
3 exhausters.....	Snyder & Raub.....	212.00
Bending roll, tinsmith's.....	D. H. Stoll Co.....	520.00
Transfer car.....	Atlas Car & Manufacturing Co.....	55.00
48 end-piling trucks.....	Morton Dry Kiln Co.....	184.32
3 cloth pinions.....	General Electric Co.....	12.30
Movable metal louvers.....	Mesker Bros. Iron Works.....	54,500.00
Steel rolling doors.....	Jas. G. Wilson Manufacturing Co.....	23,567.98
Linoleum.....	John Wanamaker.....	1,717.00
Paint, filler.....	Toch Bros.....	1,805.00
Shavings exhaust system.....	B. F. Sturtevant Co.....	6,516.00
2 refuse collectors.....	Not let yet.....	
Cloth pinions (2).....	General Electric Co.....	50.00
Sailmaker's sewing machine and motors.....	Not let yet.....	
Woodworking shaper.....	do.....	
Pipe fittings.....	The Youngstown Sheet & Tube Co.....	239.27
	The Manhattan Supply Co.....	989.18
	Crane Co.....	639.43
Belting.....	R. & J. Dick.....	4,262.00
Tees, angles.....	R. C. Hoffman.....	75.37
	Belmont Iron Works.....	255.84
Total.....		544,034.43

TABLE No. 10.—*Showing old and new equipment installed in Balboa shops.*

INSTALLATION OF MACHINES AND MOTORS.

Building.	Motors.			Machines.		
	Old.	New.	Total.	Old.	New.	Total.
1.....	15	52	67	155	5	160
2.....	5	4	9	45	2	47
3.....	4		4	4		4
4.....	13	11	24	33	3	36
5.....		2	2			
7.....	3	1	4	5		5
8.....	14	23	37	65	1	66
9.....	6	1	7	8	4	12
10.....		3	3		3	3
12.....	11	7	18	24	7	31
15.....		1	1	8		8
16.....	1		1	2		2
28.....	2		2	2	1	3
29.....		5	5		3	3
Transfer table.....		1	1	1		1
Turntable.....		1	1		1	1
Total.....	74	112	186	352	30	382

TABLE NO. 10.—*Showing old and new equipment installed in Balboa shops—Continued.*

TRAVELING CRANES.

Building.	Motors.			Machines.		
	Old.	New.	Total.	Old.	New.	Total.
1.....		11	11		3	3
2.....		3	3		1	1
3.....		6	6	2		2
4.....		7	7		2	2
9.....		3	3	1		1
12.....		10	10	2	1	3
Total.....		40	40	5	7	12

COALING PLANTS, DRY-DOCKS, FLOATING CRANES, AND RADIO STATIONS.

Design.—Design and office work in connection with the dry-docks, coaling plants, and floating cranes has been in immediate charge of Civil Engineer F. H. Cooke, United States Navy, with a force of engineers, draftsmen, and assistants numbering 18 at the end of the fiscal year.

Coaling plants.—As stated in the last annual report, proposals under circular 763 were opened in the Washington office June 14, 1913, and were received on the Isthmus for canvass just prior to the close of the fiscal year 1913. These proposals were accompanied by plans, specifications, and other data. The five proposals received are listed below:

Bidder.	Cristobal only.	Balboa only, plan "N."	Both complete.	Time of delivery (months).
David Duncan, 17 Battery Place, New York City..	\$2, 121, 660	\$1, 140, 830	\$3, 262, 490	18
Hunt Construction Co., 45 Broadway, New York...	2, 111, 813	1, 361, 285	3, 350, 497	18
Augustus Smith, Bayonne, N. J.....	1, 413, 689	901, 373	2, 300, 000	36
W. L. Bull, jr. (Inc.), 135 Front Street, New York..	2, 313, 750	1, 581, 000	3, 894, 750	22
Wellman-Seaver-Morgan Co., Cleveland, Ohio.....	960, 260	631, 131	1, 573, 390	18

The circular specified general requirements only, and the proposals were therefore in the nature of competitive designs. Although at least two general arrangements were permitted by the circular for the Cristobal plant, all the submitted designs were based on the same general layout, this consisting essentially of a pier structure inclosing the coal pile, the long sides of the pier being parallel to each other and affording support for the unloading, stocking and reclaiming, and reloading units, deep water being provided on two sides and at one end of the pier structure. At Balboa, circular 763 admitted proposals on two general designs, one known as "N," based on the provision of entirely new machinery throughout, the other known as "O," based on the utilization of the four berm cranes which were used for mixing and placing concrete at the Pedro Miguel and Miraflores Locks. There were 19 items listed in the circular whereby the work might be subdivided if advantageous; but for convenience as a general indication of the prices received, the bids for Cristobal only, for Balboa plan "N" only, and for both complete are shown above. But

one bidder, Augustus Smith, submitted a proposal under plan "O," his bid being \$570,000 for this design, time of completion, both plants, with plan "O" Balboa, 34 months. The storage capacities of the plants as contemplated by circular 763 were as shown in the following table:

	Cristobal.	Balboa.	
		Plan "O."	Plan "N."
Wet.....	<i>Tons.</i> 125,000	<i>Tons.</i> 100,000	<i>Tons.</i> 75,000
Normal dry.....	121,000	80,000	60,000
Emergency dry.....	52,800	30,000	25,000
Total.....	298,800	210,000	160,000

The foregoing is based on short tons of 2,000 pounds, or 40 cubic feet.

The general plans accompanying circular 763 permitted enlargements of both plants.

The proposals submitted were thoroughly compared, there being taken into account not only the cost of purchase, operation, and maintenance of the coal-handling machinery proper, together with the individual and combined capacities of the various units, but also the cost of the necessary substructures, and cost and amount of increase in storage capacity possible, the necessity for increase having become apparent during the period between the preparation of the circular and the receipt of proposals thereunder. As the result of the study and comparison of the proposals, the following awards were made, and two contracts, each dated August 19, 1913, were entered into for the prosecution of the work embraced thereunder, this work being the designing, fabrication, delivery, and erection, each at its proper location at Cristobal and Balboa on substructures and foundations to be designed and furnished by the Government, of handling machinery and accessories for coaling plants, complete in all respects, ready for operation:

Augustus Smith—Delivery for Cristobal plant to commence on or before Feb. 19, 1914, and to be completed on or before Aug. 19, 1915; delivery for Balboa plant to commence on or before Feb. 19, 1914, and to be completed on or before Aug. 19, 1916:

2 duplex stocking and reclaiming bridges, for the Cristobal plant only.....	\$425,068.00
6 reloaders, 4 for the Cristobal plant and 2 for the Balboa plant....	266,911.00
2 conveying systems and power substations, each complete with all accessories, including wharf bunker; 1 for Cristobal plant and 1 for the Balboa plant.....	654,513.00

Total contract price..... 1,347,392.00

Hunt Construction Co.—Erection of towers at Cristobal to begin on or before Sept. 19, 1914, and to be completed on or before Aug. 19, 1915; erection of towers at Balboa shall begin Mar. 19, 1915, and be completed on or before Feb. 19, 1916:

6 unloader towers, 4 for the Cristobal plant and 2 for the Balboa plant.....	485,736.00
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These contracts were entered into with the understanding that the Cristobal plant would be enlarged by increasing its length to 1,700 feet and its width to 308 feet, while the length of the Balboa plant was increased to 800 feet, the width remaining the same. The latter

plant is based on "0," as above described. The resultant capacities of each of the enlarged plants is as indicated below:

	Cristobal.	Balboa.
	<i>Tons.</i>	<i>Tons.</i>
Wet.....	100,000	50,000
Normal dry.....	250,000	103,000
Emergency dry.....	135,000	62,000
Total.....	485,000	215,000

The foregoing is based on short tons of 2,000 pounds, or 40 cubic feet.

Comparison with corresponding figures given in the last annual report will show that, while there has been a material increase in the quantity of dry storage at each plant, the volume of wet storage has been reduced. The Navy Department originally requested 100,000 tons of wet storage at Cristobal and 50,000 tons at Balboa. When the preliminary plans accompanying circular 763 were taken in hand it was thought desirable to increase these figures somewhat, but subsequent development indicated that a return to the original quantities was advisable from considerations of cost. The distinction between "normal dry" and "emergency dry" storage is somewhat artificial, and there is probably but little danger from spontaneous combustion at either plant if the coal is kept permanently in storage to the level corresponding to the emergency volumes. The normal dry volumes are based on a depth of 20 feet in each case.

The total volumes of storage above stated are based on no loss due to subdivision of coal piles. Dependent on the number and size of individual storage piles, the total collective capacity will be somewhat reduced below the figures above given. For example, in case the Cristobal plant is subdivided into 37 piles, the collective capacity will be reduced to 400,000 tons.

The accepted design for the Cristobal plant is in general as follows:

One of the long sides of the pier is designated as the unloader wharf and the other side as the reloader wharf. The connection between these two at the north or water end of the coaling plant is known as the end wharf. The bottom will be dredged to afford a depth of 41 feet at mean sea level for a distance of 1,065 feet along the unloader and reloader wharves, this distance being measured from the extreme northerly end of the plant. This same depth will be carried along the end wharf; thus the finished plant will have approximately 2,500 lineal feet of berthing space with a depth of 41 feet at mean sea level. The tide does not fall more than 1 foot below mean sea level, so that deep-draft vessels can be accommodated at any stage of the tide. The decks of all wharves are 10 feet 6 inches above mean sea level. Beyond the end of the dredged area the bottom rises comparatively rapidly, and at the southerly end of the coaling plant a length of approximately 600 feet is considered as a shore extension, and has no water front. The coal pile is spanned by two movable steel structures known as stocking and reclaiming bridges, which are capable of traveling the entire length of the pile. These bridges are heavy steel structures, each supported on 32 wheels at each end, the unloader wharf affording support for one end of the

bridges and the reloader wharf for the other. The distance center to center of end bearings is 315 feet. The upper chords of each of these bridges will support other moving units known as bridge diggers. As these can move longitudinally of the bridge and the bridges move longitudinally of the pile, the bridge diggers can command any part of the storage pile.

The unloader wharf also supports four moving units known as unloaders, each of which is supported on 16 wheels which run on two pairs of rails 34 feet 6 inches center to center. The unloaders have a travel of slightly more than 1,000 feet, and command the entire length of the deep-water mooring berth on the unloader side of the plant. The reloader wharf affords support for four moving units known as reloaders, each of which is supported on 16 wheels which run on two pairs of rails 26 feet center to center. The maximum range of the reloader travel is such that they command practically all of the deep water mooring berth on the reloader side of the plant. The end wharf affords support for a wharf bunker of 1,500 tons capacity, which is provided for the supply of coal to tugs and other comparatively small craft, thus rendering it unnecessary to start up the plant in order to furnish a small amount of coal.

Surrounding the entire coal pile is a double-track elevated railroad of 3-foot gauge supported by a steel viaduct structure, the top of rail being 29 feet 6 inches above the deck of the wharf. The viaduct is supported by the unloader wharf, end wharf, and reloader wharf, and by pile foundations at the shore extension. There is about 1,200 linear feet of storage track at the same elevation, situated at the west side of the shore extension and connected to the operating lines by suitable curves and switches.

The unloaders are operated by steam; the remainder of the plant is operated by electricity and all parts are electric lighted throughout. The current for power and lighting is alternating, 3 phase, 25 cycles. The Panama Canal supplies this current at 2,300 volts to a substation included in the contract. This substation is located on the west side of the plant where the reloader wharf joins the shore extension. The current is stepped down to 440 volts for power and 110 volts for lighting, a part of the necessary transformers being located on the moving units themselves and the remainder in the above-mentioned substation. The 2,300 volt current will be supplied from the main Cristobal substation and will be brought to the coaling-plant substation through duct lines, submarine cables being used to effect the crossing of the French Canal which separates the coaling plant from the mainland.

Railway connection to the Panama Railroad is had by a line crossing the French Canal to the south of the Cristobal Dry Dock. On the coaling-plant side of the French Canal the railroad connection is continued in two lines, one on the unloader side and the other on the reloader side of the coaling plant, these lines being extended the full length of the coaling plant. The tracks on which the stocking and reclaiming bridges run are of the standard 5-foot gauge of the Panama Railroad, and they will be connected at their south ends to the above-described lines, thus there will be four parallel lines of standard-gauge track extending the full length of the coaling plant and connecting to the main line of the Panama Railroad.

The operation of the coal-handling machinery is in general as follows:

For unloading and stocking, coal is taken from colliers or barges by one or more of the unloaders, which are equipped with $2\frac{1}{2}$ -ton buckets and have a normal rated capacity of 250 tons per hour each. This coal is delivered to cars running on the elevated railroad, each car having a capacity of 10 tons and a speed of 200 feet per minute. The cars are stopped and started by trackmen working on the viaduct, no attendance being necessary when the cars are in motion. The cars are of the "W" bottom type and they are dumped by the trackmen at the desired points. After having been filled with coal the cars are started and travel to the desired point for dumping over a predetermined route, no throwing of switches being necessary in the normal operation. For stocking, the cars must dump at some point over the coal pile, and this is done from a track at about the level of the lower chord of the stocking and reclaiming bridges, which track is connected to one of the elevated tracks on the viaduct paralleling the bridge travel, by means of a sliding switch which moves with the bridge and guides the cars on to the bridge. If the coal delivered to the cars by the unloaders is destined for the wharf bunker or the reloaders, the cars do not necessarily cross the stocking and reclaiming bridges, although in some cases this route is shorter and would probably be followed.

The coal is reclaimed from storage by means of one or more of the four bridge diggers which run on the top chords of the two stocking and reclaiming bridges. These bridge diggers are each equipped with a 5-ton coal bucket, and each has a normal rated capacity of 500 tons per hour. The coal thus reclaimed is delivered by suitable hoppers and valves to the coal cars, which transport the coal to the desired point, which may be either the reloaders, wharf bunker, or to some other part of the storage pile by means of the other stocking and reclaiming bridge.

The wharf bunker receives its coal by means of a series of belts fed from a hopper, into which the coal is dumped from cars. The reloaders are supplied with coal also by belts. Each reloader is provided with an appendage known as a "trailer," which consists essentially of a hopper supported on wheels which receives coal from the cars and delivers it to an inclined belt supported by a truss which connects the wheeled hopper to the reloader proper, thus the trailer travels with the reloader. From this inclined belt the coal is delivered to a second belt carried by the reloader proper, this belt being supported by a hinged truss capable of considerable range of motion in a vertical plane and fitted at its water end with a hinged telescopic chute. The hinged truss and chute are raised and lowered by steel wire ropes passing over sheaves secured to the tower structure and actuated by drums, and a very considerable range of point of discharge is had. These reloaders take the place of the heavy and expensive wharf bunkers which have been provided in most coaling plants elsewhere. They are comparatively inexpensive while affording a range and capacity of discharge equal to that of a very high wharf bunker.

The weight of coal handled is ascertained by semiautomatic scales provided at suitable points along the elevated railroad, and the operating routes are such that a car must pass over a scale before

reaching its point of discharge. It is proposed to use a duplicate system of weight tickets, on which the scales will print the weight of each car, thus effecting an automatic check on quantities handled. A set of standard railroad scales is also provided for the railroad track at the wharf level which runs under the unloaders, thus ascertaining the weight of coal delivered to standard-gauge railroad cars by the unloaders, for which delivery suitable valves and chutes are provided on the unloaders.

A complete system of communication and signals, these latter being both visible and audible, is included in the contract. It will be seen from the foregoing description that for unloading operations the total normal rated capacity is 1,000 tons per hour and for reclaiming and reloading operations 2,000 tons per hour. To attain these normal rated capacities the individual units must work at somewhat higher rates when the conditions are most favorable, and the total maximum capacities are 1,200 tons per hour for the unloaders and 2,400 tons per hour for the bridge diggers and reloaders. These rates of handling are quite high, and there are some somewhat novel combinations of parts going to make up the finished plant. The contractors concerned have been engaged during the year in perfecting their general designs and in working out the great mass of detail necessary.

The general plan of the Balboa plant is materially different from that of the Cristobal coaling plant, due to difference in local conditions. The general functions of the unloader and reloader wharves are the same as at Cristobal, but instead of being parallel these wharves make an angle of approximately 135 degrees with each other, thus forming a salient angle. The unloader wharf is approximately 850 feet long and the reloader wharf approximately 750 feet long, thus making a total length of approximately 1,600 feet of wharfage, at which there is a depth of 45 feet at mean sea level and of 34.4 feet at extreme low water. At the Balboa coaling plant the handling capacities are approximately half those at the Cristobal coaling plant, there being two unloaders and two reloaders at the Balboa plant. The transfer of coal is effected by means of 10-ton electric cars running on a single-track elevated railroad of the same gauge as at Cristobal, this track being supported in part by a steel viaduct and in part by concrete piers built in connection with the general substructure. The Balboa cars dump on one side only; at Cristobal they dump on both sides. They receive coal either from the unloaders or from the berm cranes and dump directly into the storage pile or to the hoppers of the wharf bunker or of the reloaders, as desired. The wharf bunker and reloaders are practically the same as described for Cristobal. The current for lighting and power at Balboa is the same as at Cristobal so far as the contract work is concerned, and is brought to the contractor's substation from the main Balboa substation by cables and duct lines supplied by The Panama Canal. The four berm cranes are operated by direct current, and provision is being made in the coaling-plant substation for housing the necessary rotary converters, which are on hand.

It is incumbent on The Panama Canal to supply suitable foundations and substructures for the support of the fixed and moving parts of the coal-handling machinery proper. The loads to be carried are in many cases quite heavy; for example, the load imposed on the

substructure by one end of a stocking and reclaiming bridge can reach a maximum of nearly 1,000 tons. It is necessary that the maximum loads imposed by the superstructure be definitely known before the final design of the substructure is worked out, and thus the completion of this detailed design must follow the final determination of the superstructure loads.

At Cristobal the substructure may be divided into two main divisions. The first of these comprises a length of approximately 1,170 feet and forms that part of the plant where deep water mooring berths are available. This part of the substructure consists of a steel and concrete deck supported by concrete cylinders 6 feet in diameter founded on solid rock. The spacing of the concrete cylinders is largely dependent on the spacing of the rails for the support of the moving units and the design of the deck framing has also been largely influenced by the position of the superimposed loads. The deck structure framing will consist of steel plate girders and steel beams, which will be entirely encased in concrete and will support a reinforced concrete deck slab. In all there will be required about 5,000 tons of structural steel and 18,000 cubic yards of reinforced concrete in the deck, which has an area of approximately 200,000 square feet. Three hundred and six concrete cylinders, 6 feet in diameter, and ranging between 50 and 75 feet in length, will be required to support this deck.

The other main part of the Cristobal substructure is that required in the shore extension, and consists of the necessary supports for the stocking and reclaiming bridge tracks and for the viaduct posts. These consist of concrete walls and piers supported by piles and have presented no great difficulty in design or construction.

At Balboa the reloader wharf design is very similar to the deck cylinder construction described for Cristobal, while the unloader wharf will be somewhat different, in that the steel and concrete deck will be supported by rectangular concrete piers built for the most part in the open and in the dry rather than by cylinders sunk through water and subsoil to the underlying rock.

At the end of the fiscal year the final design of the Cristobal deck structure was nearly completed and about 40 of the supporting cylinders had been sunk. At Balboa the designs were not so far advanced.

The inspection of work connected with the contracts for the coal handling machinery in the States is being performed by the Washington office, with Assistant Engineer F. H. Moore in immediate charge of the inspection of all structural and mechanical work, and Assistant Engineer F. A. Browne in immediate charge of the inspection of all electrical work.

These coaling plants are intended to meet all military, commercial, and canal requirements. The main plant has been placed on the Atlantic side, from which side the coal supplies are expected to come. Were it not for the military necessity of having an independent and additional coal supply at the Pacific end of the canal, the Balboa coaling plant would not have been undertaken at this time. Similarly underwater storage for coal is being provided both at Cristobal and at Balboa in amounts requested by the Navy Department, in order to provide for the permanent storage of large amounts of coal without it being subject to deterioration in quality that occurs on long exposure to the air and to avoid danger of loss and damage through spontaneous combustion.

Military usefulness.—The high rates of handling coal which were prescribed in the specifications were fixed with a view to making the military usefulness of these coaling plants a maximum by enabling vessels to discharge coal as well as to take coal as rapidly as naval vessels can be served anywhere in home ports. The total storage capacity being provided at each plant has been fixed with a view to meet naval requirements for coal without interfering with necessities liable to arise in connection with providing of storage applied for by individuals and companies from a commercial standpoint.

Commercial usefulness.—The commercial usefulness will in part result from the policy which was adopted in 1913, as described in the last annual report, of providing storage for all individuals and companies who desire to participate in the business on the Isthmus of supplying coal to vessels that use the canal. The necessity for this originated from the fact that the leasing of land or land under water in the Canal Zone has never been authorized by Congress except for agricultural purposes, and in the absence of such legislation individuals and companies would not be warranted in making outlays for permanent improvements under a revocable license that they might be required to vacate at any time without reimbursement for the value of improvements made. The coal piles of individuals and companies will be served by the same machinery that handles Panama Canal coal.

A large number of inquiries and applications have been received during the year for storage space, both at Cristobal and at Balboa. Up to the end of the fiscal year no definite assignments of space had been made and the rates for storage and handling had not been fixed. All applicants have been informed that it is the aim to provide all reasonable storage space that they may require. Until the permanent plants have been completed it has been arranged that the Panama Railroad Co. will make all necessary provisions to sell to vessels using the canal any coal that they may require. In general, the Panama Railroad expects to continue to use the coal slip and the Brown hoist machine at Mount Hope for unloading colliers into the stock pile and into cars. An auxiliary wharf has been constructed at the north end of Dock 13, which enables the cars loaded with coal to be run up an incline and dumped into barges. The Panama Railroad Co. expects to use such barges as are available on the Isthmus in this service, either in their present condition or fitted up with coaling booms and coal hoists for transferring coal to vessels by power. The experience gained during the interval between the opening of the canal and the completion of the permanent coaling plants will enable a decision to be reached as to the necessity of supplementing the coaling plants and the available barges with any auxiliary coaling lighters or barges.

Canal usefulness.—In addition to the military and commercial usefulness of the coaling plants they will be expected to furnish all coal for The Panama Canal and the Panama Railroad Co.

The amount of business these plants will do is more or less problematical and will depend not only upon the cost of the coal to vessels, but also upon the relative cost of coal and fuel oil in general, as well as the amount of fuel oil that is available. Based upon the expected canal traffic and the sales of coal at the entrance to the Suez Canal,

in time the sales at the Isthmus may be expected to reach upward of 1,000,000 tons per annum. During the present fiscal year the Panama Railroad, which purchases all coal brought to the Isthmus, reports coal deliveries on the Isthmus amounting to 355,156 tons.

Colliers.—Of the total cost of coal from the States delivered at the Isthmus, about one-third represents the cost of the coal at the mine; one-third the cost of transportation by rail to the seaboard; and the remaining third represents the cost of transportation by water to the Isthmus. During the year the cost of water transportation to the Isthmus has been \$1.395 per ton. The coal is brought down in foreign bottoms. The cost of water transportation is subject to fluctuations. The present favorable price results from the ability of the colliers to secure cargoes in Cuba on returning to the United States. The successful operation of the coaling plants is contingent to some degree upon ability to control the transportation of coal from the States as regards cost, quantity, and rates of delivery. Early in the consideration of the coal supply problem the conclusion was reached that advantages would result from the ownership by The Panama Canal or the Panama Railroad Co. of the colliers bringing coal from the States to the Isthmus. The Navy Department proposed some time ago that all coal should be brought to the Isthmus in naval colliers. This would justify the construction of additional naval colliers, which in time of peace could be used in the transportation of coal to the Isthmus. In time of war these colliers would be able to render valuable service as naval auxiliaries. As Congress did not seem inclined to favor naval control of Panama Canal colliers, an estimate was submitted with the canal estimates in 1912 that would permit the construction by The Panama Canal of two colliers, in accordance with the latest type of naval colliers, and would give The Panama Canal the desired control over its coal supply. An appropriation for these vessels was included in the sundry civil bill approved June 23, 1913, reading as follows:

The construction in the United States in Government or private yards, in accordance with plans and specifications to be prepared by the Navy Department, and to have a cargo capacity of 12,000 tons of coal and a speed of not less than 14 knots per hour, two colliers to cost not exceeding \$1,000,000 each.

The Navy Department was requested to prepare the plans and specifications for these vessels and to perform the inspection thereof. Plans showing the general design, characteristics, cargo holds, etc., were forwarded to the Isthmus by the Navy Department on October 15, 1913, and same were approved in general by the chairman and chief engineer on November 1, 1913. Proposals were thereupon invited by the Navy Department, and on February 2, 1914, bids were opened on the construction of these colliers, as follows:

Newport News Shipbuilding & Dry Dock Co.:	
One vessel substantially in accordance with the department's plans and specifications, without coaling gear (also other changes as specified), class 4.....	Each. \$995, 000
Or two vessels at.....	995, 000
Seattle Construction & Dry Dock Co.:	
For the construction of two vessels complete in accordance with the department's plans and specifications, including coaling gear, class 1.....	1, 436, 000
For two vessels in accordance with the department's plans and specifications, but without coaling gear, class 3.....	1, 400, 000

Maryland Steel Co.:

Each.

For the construction of two vessels in accordance with the bidders' design of hull and machinery, complete, including coaling gear, class 2.....	\$1, 022, 000
For two vessels constructed in accordance with a duplicate contract of the <i>Orion</i> and <i>Jason</i> , including coaling gear, coaling hatches, and cargo subdivision arranged to suit canal terminal facilities, class 2 modified.....	945, 000
For two vessels in accordance with the bidders' design, but without coaling gear, class 4 modified.....	987, 500
For two vessels constructed in accordance with the bidders' design but without coaling gear, class 4.....	970, 000

The foregoing bids were forwarded to the Isthmus under date of February 27, 1914, and on April 7 the Governor of The Panama Canal recommended that contract for the construction of the colliers be awarded to the Maryland Steel Co. On April 9, 1914, contract was accordingly entered into by the Navy Department with the Maryland Steel Co. for the construction of two colliers at \$987,500 each. In view of the character of service which these colliers will be called upon to perform, and the importance of maintaining their schedule with a minimum of delays for repairs, the Navy Department was requested to specify boilers and machinery somewhat in excess of ordinary ratings and specifications, in order to obtain as great reserve power and strength as the funds available would permit. Each collier is to have a cargo carrying capacity of 12,000 tons of coal and a speed of 14 knots per hour when loaded to full capacity. In accordance with the contract, these colliers are to be delivered to The Panama Canal at Baltimore, Md., or Hampton Roads, Va., at the option of The Panama Canal, on or before August 9, 1915.

On June 30, 1914, the Secretary of War decided that these colliers, when completed, will be operated for The Panama Canal by the Panama Railroad Co. in a manner similar to the operation of the vessels of the Panama Railroad Steamship Line. The Panama Railroad Co. has submitted an estimate, based on 17½ round trips per annum and the transportation of 210,000 tons of coal, of the cost of transportation amounting to 97 cents a ton, not including depreciation or interest on capital invested. These colliers, which have been given the names *Achilles* and *Ulysses*, respectively, will be completed by the time the permanent coaling plants are ready for operation, and should prove very valuable auxiliaries to the economical and successful operation of The Panama Canal.

Dry docks.—The general description and principal dimensions of Dry Docks 1 and 2 at Balboa were given in the last annual report, and no material changes have been made since then. On account of other and more pressing demands on funds, it was decided toward the end of the fiscal year to defer the construction of Dry Dock No. 2 until later. Such of the dock structure as serves as an entrance pier for Dry Dock No. 1 and as will permit the future completion of Dry Dock No. 2 in the dry without especial increase in cost, will be built now. This will be attained by building the south wall of Dry Dock No. 2 practically as originally contemplated, and to remove the cofferdam which now excludes the water from the general entrance basin and dry excavation, only to such point as is necessary to give free entrance to Dry Dock No. 1. The remainder of the cofferdam, with a short connection to the south wall of Dry Dock No. 2 will permit the

remainder of Dry Dock No. 2 to be constructed in the dry without difficulty, when desired.

The detailed design of these structures has been to a very considerable extent dependent upon conditions developed during the progress of the excavation. At the close of the fiscal year the excavation had proceeded sufficiently far to enable the greater part of the determining conditions to be known as regards concrete work.

The contract entered into October 22, 1912, with the McClintic Marshall Construction Co., of Pittsburgh, Pa., for one pair of steel miter-gate leaves and fixed irons was completed during the fiscal year, and material is stored on the Isthmus awaiting erection.

The moving machines for operating these leaves, together with the motors, controls, and covers, noted in the annual report for 1913 as having been ordered, were received on the Isthmus during the fiscal year and stored.

Requisition was issued for the purchase of cut granite for the caisson sill and miter-gate sill of Dry Dock No. 1, together with a quantity of rough stone to replace possible breakages. Proposals for this stone were opened by the Washington office on June 25, 1914, but had not been received on the Isthmus for canvass at the end of the fiscal year.

Floating cranes.—As stated in the last annual report, contract was entered into on April 21, 1913, with the Deutsche Maschinenfabrik A. G., of Duisburg, Germany, for the construction of two floating cranes of the revolving type and of 250-tons capacity each, at a total cost of approximately \$837,500, to be delivered and completed on the Isthmus within 580 days, or by December 2, 1914. This price is based on the acceptance of the contractor's alternate proposal No. 1, which was \$827,550, so as to provide for 220-volt enclosed motors and other minor changes considered desirable, for which the additional price was \$9,350. Six additional limit switches were also ordered, three for each crane, at a further cost of \$100 each, or a total cost of \$600. During the year a supplemental agreement was executed covering a condenser outfit for each crane, at a total cost of \$10,000, making the total contract price of the two cranes \$847,500. There have been no material changes in the construction and capacity of the cranes as described in the last annual report.

During the year, the contractor made rapid progress on the design and construction of these cranes. Assistant Engineer Henry Schoellhorn has been stationed at the contractor's works during the year as the representative of The Panama Canal, under the Washington office, and as such has approved all contractor's plans and has been in general charge of the inspection of material and work. Mr. Herman Bornmann, who was appointed in the United States, has acted as his principal assistant. Other inspectors were employed in Germany. The Germanic Lloyd inspection bureau was employed to perform some of the inspection, including mill inspection of certain materials, inspection and testing of boilers and piping in the pontoons, and the inspection of the anchors.

The following were the principal subcontractors:

Design and construction of pontoons, Deutsch-Luxemburgische Bergwerks & Huetten A. G. Abtl. Nordseewerke at Emden.

Boilers, piping, capstans and anchor winches, Gebr. Sachsenberg at Rosslau, Anhalt.

Condenser equipment, Firma Uebigau Dresden.

Power plant unit, electric light unit and installation of same, electric light wiring in pontoons and on crane structures, motors, and all control equipment, Allgemeine Electricitaets A. G., Berlin.

Steam engines for power plant unit and electric light unit, Werft Schichau, Elbing.

During the year 547 drawings were approved.

The cranes have been given the names *Ajax* and *Hercules*, respectively.

Pontoons.—Each pontoon required 980 long tons of structural steel and 20 long tons of oak as fenders. The fittings, including capstans, anchor winches, anchors and chains, anchor flanges, etc., for each pontoon weigh 53.7 long tons. The boiler for each pontoon weighs 41 tons. One hundred and thirty tons of concrete were used in cementing the bottom of each pontoon, and 450 tons for counterweight in the stern. The following is a schedule showing the date of beginning work on each pontoon and the date when the pontoon left Emden under tow for the Isthmus:

	"Ajax."	"Hercules."
Bottom plates laid.....	July 29, 1913	Aug. 10, 1913
Launched.....	Jan. 8, 1914	Feb. 24, 1914
State of completion of hulls when launched:		
Erected.....	93 per cent.	97 per cent.
Riveted.....	70 per cent.	78 per cent.
Hulls completed and date of departure from Emden.....	Apr. 26, 1914	May 30, 1914

The weight of the structural steel above the deck of the pontoon for each crane is as follows:

	Tons.
Tower.....	120
Bell.....	300
Jib.....	123
Total.....	543

All of this work was manufactured at the Benrath shops of the contractor. Work on the towers and bells started on October 1, 1913, and as the different parts were completed they were shipped to Emden for erection by the contractor. Erection began on December 1, 1913. The jibs, counterweight arm, machinery house, machinery, spare parts, foundry patterns, and erection equipment were shipped from Antwerp direct to the Isthmus in April, 1914. All work not erected at Emden was assembled at the Benrath shops before shipment.

Machinery.—The machinery above deck, including all hoisting, slewing and luffing machinery, weighs about 368 tons. The greater part of this material was manufactured at the Benrath shops. About 40 tons of this was erected at Emden and the rest shipped knocked down to the Isthmus.

Electrical equipment.—The electrical equipment, consisting of steam engines and generators for the power and electric light units, motors, brake solenoids, switchboards, controllers, electric light system, slip-ring contactors and rings, was installed and the power plant was given a thorough capacity test before the pontoons left Emden. When the pontoons left Germany their general condition was as follows.

Completed: Pontoons. Power and electric-light plants. Power and control wiring within pontoons, and to the slip rings on the towers. All electric-light installation for pontoons and crane structures. Towers.

Partially completed: Bell, with exception of counterweight arm, machinery house and machinery for same, spindle carriage and spindles.

The jibs, of course, were not erected on the crane structure. The spindle carriages with their cast-iron counterweights and spindles were lashed to the decks of the pontoons for shipment. The pontoons had not arrived at the Isthmus at the end of the fiscal year but were expected in July.

Erection.—The erection to be done after arrival on the Isthmus consists in general of the erection of the spindles, spindle carriages, counterweight arms, machinery rooms, and contained parts supported by the bells, and the completion of the necessary connections for operation and control. The first part of this erection work will be done at Dock 14, Cristobal, where berths for the pontoons have been reserved for the contractor's use. The jibs will be assembled on the east side wall of the east middle lock at Gatun, and will be attached to the bell by bringing the pontoon into the lock chamber, lowering the water level sufficiently, and moving out the jib so that it will project beyond the lock wall sufficiently far to render its attachment possible. The first material for the jibs arrived on the Isthmus May 18, 1914, and the greater part of the contractor's erection force arrived on the Isthmus during May and June. At the close of the fiscal year the work of assembling and riveting up the jibs was in progress. It is incumbent on The Panama Canal to furnish the necessary test weights and slings for the acceptance tests of the cranes. These tests are expected to take place during November, 1914, and steps are being taken to provide the test weights and slings.

Assistant Engineer Schoellhorn arrived on the Isthmus from Germany on June 22, 1914, and will be in immediate charge of the inspection of the cranes and the testing of same after completion.

The following is a summary of the weight of each crane, complete, in long tons:

	Tons.
Pontoon	1, 634. 4
Electric plant, coal, water, etc.....	173. 7
Structural steel for superstructure, including tower, bell, and jib.....	543
Machinery.....	368
Counterweight, motors, control, etc.....	150. 2
Total.....	2, 869. 3

Radio stations.—The Navy Department, in accordance with authority granted by the President of the United States in 1911 on the recommendation of the Secretary of War and the Secretary of the Navy, and with its funds provided by subsequent legislation, has authorized the construction of three radio stations in the Canal Zone.

The main or primary station for long-distance communication is located at Darien, along the Panama Railroad and adjacent to the shores of Gatun Lake, about midway between the Atlantic and Pacific Oceans. In addition, there will be two secondary stations, one located at Balboa dumps on the shores of the Pacific, about a mile from Balboa administration building, and one on the shores of the Atlantic in Colon, on the site of the radio station that has been maintained by the Navy Department for the last eight years. The prin-

cial duty of these two secondary stations will be to transmit messages to and from vessels in the adjacent canal waters, and within a radius of about 300 miles from the canal.

All these stations are intended to transact canal and commercial as well as naval business. The construction of these stations, except the operating equipment, is under the jurisdiction of the Bureau of Yards and Docks of the Navy Department, and, at the request of the bureau, Civil Engineer F. H. Cooke, United States Navy, has been detailed, in addition to his other duties, as inspector on the Isthmus of all work in connection with these stations under the Bureau of Yards and Docks. Supervisor Ira W. Dye has acted as his principal assistant on this work since March 11, 1914. The Bureau of Steam Engineering has jurisdiction over the purchase and installation of the operating equipment, which work is to be performed under the supervision of the naval radio officer on the Isthmus, Lieut. R. S. Crenshaw, United States Navy.

The aerial of the Darien station will be attached to the tops of three self-supporting steel towers, each 600 feet in height above the foundations. The aerials of the Colon and Balboa stations will be attached to the tops of two self-supporting steel towers, each 300 feet in height above foundations. The contract for the steel towers at Darien station was awarded by the Navy Department to the Penn Bridge Co., of Beaver Falls, Pa., for the fabrication and erection of the three towers. The contract is dated June 26, 1913, and the price is \$112,350. The three towers weigh about 980 tons. The contract for the four 300-foot towers, required for the Colon and Balboa stations, was awarded, on May 18, 1914, to A. W. Kurz, of New York City, for \$19,955. These four towers weigh about 200 tons. The first shipment of structural steel for the Darien towers was delivered at the site early in June, 1914. No steel had been erected by the subcontractor at the end of the fiscal year. No steel-work for the Colon and Balboa towers had been delivered up to the end of the fiscal year.

The contract for the power plant and radio equipment for the Darien station was awarded by the Navy Department to the Federal Telegraph Co., of San Francisco. The contract is dated June 30, 1913, and amounts to \$52,691.33. It is understood that the Navy Department does not intend to purchase any new radio equipment for the Colon and Balboa stations, but to utilize equipment at present in use on the Isthmus for practically the entire installation for both stations.

The work performed on the Isthmus during the year at each station includes the design and installation of the foundations for the towers, the construction of buildings, the installation of water system, sewer system, roads and walks, grading, clearing of ground, etc. The work has been performed by the various departments and divisions of The Panama Canal as follows:

The supply department has built the foundations and buildings and has done considerable clearing.

The division of municipal engineering has installed the water supply and sewer systems and constructed roads at the secondary stations.

The electrical division has performed services and work connected with the electrical installations.

The fortifications division has done some clearing, and the general construction division and the Panama Railroad have done some grading.

Surveys and field engineering was carried on by the section of general surveys of the department of operation and maintenance.

At each of the three stations buildings are required for housing the power-generating and the transmitting and receiving apparatus, as well as living quarters for the operating forces. At Darien these buildings comprise operating building, power house, substation for stepping down the high potential voltage carried by the trans-Isthmian transmission line, operators' barracks, quarters for the officer in charge and chief electrician, and a storehouse. At Colon and Balboa the buildings comprise operating building, power house, operators' barracks, and one set of double quarters for the chief electricians. At Balboa there is, in addition, a storehouse. In each case the quarters are of frame construction and the remainder of the buildings of concrete. The preparation of plans, issuance of construction directions, and general supervision of the construction work has been performed by the division of terminal construction.

At the close of the fiscal year the tower foundations were completed at each of the three stations, as was the greater part of the building and municipal work at the Darien station. At the Colon and Balboa stations the buildings, water supply, and sewerage installations were well advanced, considering the date on which the construction of these stations was authorized by the Navy Department.

FUEL-OIL PLANTS.

Assistant Engineer F. C. Nichols has been in immediate charge of the design of permanent fuel-oil storing and handling plants since January, 1914. Prior to January Mechanical Engineer A. L. Bell had been engaged in making preliminary studies and investigations relating to these plants. Up to the end of the fiscal year, no construction work had been undertaken other than the completion of the four 42,000-barrel tanks, 93 feet in diameter by 35 feet in height; two at Mount Hope and two on Balboa dumps, referred to in the last annual report. As a part of these plants, The Panama Canal expects to furnish, at each end of the canal, the necessary dredged berths and cribs, or wharves, and pipe lines from the water front to the pumping plants, that will enable oil to be handled from storage tanks to three vessels simultaneously, or vice versa, at the rate of 1,200 barrels per hour for each vessel. There will be two pumping plants, one at Balboa and one at Mount Hope. In each plant provision is being made for the installation of three pumps, two of which will be purchased at the present time. These pumps will also be able to handle oil from Balboa to Miraflores tank, and from Mount Hope to Gatun tank, at the rate of about 400 barrels per hour. On the Atlantic side, as much of Docks 13 and 14 as necessary will be used as oil docks, and the tank field will be located between the east diversion and the Mount Hope road, where there are suitable locations for between 40 and 50 tanks. The pumping plant will be located immediately east of the Mount Hope filtration plant. Lots for the erection of tanks are being leased at Mount Hope, under

revocable license, measuring about 300 feet square, for \$300 per annum. Up to the end of the fiscal year, the following lots had been leased: Nos. 8 and 24, to the West India Oil Co., New York City, Nos. 19, 21, 22, and 34, to the Standard Oil Co., of New York. Additional tank sites are available on the east side of the diversion, if needed.

At the Pacific terminal, there will be a berth for oil vessels 75 feet wide by about 2,000 feet long, immediately adjoining the canal channel about 2,000 feet south of the old French pier. There will be three oil cribs, two of which will be constructed at once, consisting of a steel and concrete deck, supported on 6-foot concrete cylinders.

Dolphins will be provided in addition, as may be required. The pumping plant will be located on the lower level of Balboa dump, opposite the oil cribs. The tank field has been laid out on the higher level of Balboa dumps. An area has been reserved, providing for 33 lots 200 feet square. These lots are being leased under revocable license for \$200 per annum. Up to the end of the year the following lots had been leased: Nos. 21, 22, 23, and 24, to West India Oil Co. (Ltd.), of New York; Nos. 17, 19, and 20, to the Panama Agencies Co., Panama, R. P.; Nos. 13, 14, 15, and 16, to Standard Oil Co., of New York.

Additional ground is available, if any greater number of tanks have to be provided for.

Both at Mount Hope and at Balboa the licensees are required to pay the cost of furnishing, erecting, and protecting their tanks, and for the pipe lines connecting their tanks with the pumping plant.

Until the termination of the existing contract on December 31, 1914, all fuel oil used on the Isthmus and supplied vessels using the canal is being furnished by the Union Oil Co. of California. Upon the termination of this contract it is intended that the oil pipe line across the Isthmus shall be removed, as the completion of the canal renders the same no longer necessary.

Upon the completion of the permanent oil plants, it is proposed to fix a charge on the sale of all oil in the Canal Zone of $1\frac{1}{4}$ cents per barrel. The charge for handling oil, both from vessels to tanks and from tanks to vessels, will be based upon the cost of this service to The Panama Canal and will be uniform to all parties.

During the year the necessary topographical and other surveys and calculations have been made for use in designing the plants and requisitions have been prepared and forwarded for the necessary pumps, valves, and fittings, for which proposals were opened by the Washington office on June 11, 1914. Award had not been made at the end of the fiscal year.

At the end of the fiscal year the monthly consumption of fuel oil by The Panama Canal and the Panama Railroad was about 63,000 barrels of 42 gallons each. The contract price is \$1.10 per barrel, delivered in the customers' tanks at any point along the Isthmus.

PIER AND WHARF CONSTRUCTION—PACIFIC TERMINALS.

General.—Work on the design and preparation of working drawings for Pier No. 1 and for all wharves and quay walls at Balboa, except the approach wall forming the north side of the entrance to Dry Dock No. 1, was continued under the immediate direction of Assistant

Engineer W. Rowland, whose headquarters have remained at Corozal. The force under Mr. Rowland at the end of the fiscal year numbered six drafting and office assistants. During the year this office completed 151 tracings covering work of the division of terminal construction; 2,132 blue prints and 80 Vandyke negatives were issued during the year. In addition, this force prepared plans for a mine-planter's dock at Naos Island for the fortifications division, plans for the concrete tile plant at Corozal for the supply department, and also prepared plans for the sanitary department, for the old fifth division, and others.

Quay Wall "G H I" and Pier No. 1.—During the year plans for quay-wall section "g h i" were completed; 11 in all. Plans were similarly completed for the reinforced concrete deck of Pier No. 1, comprising 60 tracings. The original plan providing two depressed tracks through the center of this pier, was changed at the request of the Panama Railroad Co. The present plan is to omit the center tracks entirely in order to provide greater space for storage, and to fill the area formerly occupied by the depressed tracks up to subgrade with rock and to pave this area with brick and wooden blocks on hand at the same level as the remainder of the pier. Comparative plans and estimates for the pier shed were made and the design definitely adopted in September, 1913, for a building 160 feet wide by 1,000 feet in length, and a height of 26 feet to the bottom chord of the roof trusses, embracing steel columns, trusses, and purlins, with reinforced concrete roofing tile. The tile was manufactured under supplemental agreement by the American Cement Tile Manufacturing Co., who made the tile for Balboa shops; The Panama Canal being allowed a 10 per cent reduction from the original contract price. Up to the close of the fiscal year, no steps had been taken to purchase the steel for the pier shed pending a determination of the status of the funds available during 1914-15 for this purpose.

Small-boat landings.—The plans for the walls at the head of slips Nos. 1 and 2, forming the small-boat landings, comprising 41 tracings, were completed. Comparative designs for the floats, or pontoons, of wood, steel, and reinforced concrete, were made, and as a result reinforced concrete construction was adopted. Plans for gangway bridges having a width of 6 feet in the clear were made.

Quay walls "d e" and "e f."—Plans for quay walls "d e" and "e f" have been completed, 28 in all. Quay wall "d e" has a frontage of 290 feet, running northwest and southeast, at right angles to quay wall "e f," which has a frontage of 775 feet and runs northeast and southwest. Both of these walls have a width of 61.7 feet and are of similar construction, as described generally in the annual report last year. The live load for which these piers have been designed is 750 pounds per square foot. Wharf "d e" is also designed to carry along the water front a 50-ton locomotive crane having a track gauge of 22 feet. Wharf "e f" is designed for standard-gauge railroad track along the water front. At the northeast end of wharf "e f" provision has been made for the erection of sand bins for a length of 150 feet, to be served by one of the old electrically driven overhead gantry sand cranes. On account of these sand bins with their approach tracks, a length of 16 panels, or 336 feet, from the northeast end, wharf "e f," has been designed for a uniform live load of 1,000 pounds per square foot. Both of these wharves will have a deck of struc-

tural steel construction, incased in concrete. There will be a 7-inch floor slab of reinforced concrete. The wearing surface will be of vitrified paving brick.

Unloader and reloader wharves.—The south side of the entrance slip of Dry Dock No. 1 will be bounded by a wall 1,052 feet in length, which has been termed the “unloader wharf,” as the unloading towers of the coaling plant will have a travel of about 800 feet along this wall. Beyond the angle in the wharf there will be a wharf 745 feet in length, which has been designated the reloader wharf, as the reloading towers of the coaling plant will have a travel along this wall of about 500 feet. The unloader wharf, in general, will consist of concrete piers founded on rock placed at right angles to the direction of the wall, spaced 25 feet center to center. Piers will be 6 feet thick and of varying length. The deck of the wharf will consist of steel girders, incased in concrete. The deck slab will be of reinforced concrete. The reloader wharf will be of construction similar to wharves “d e” and “e f,” viz, concrete cylinders, steel deck incased in concrete, and reinforced deck slab.

TUGS.

As stated in the last annual report, an estimate was included in the canal estimates for the fiscal year 1913–14 for the purchase of four harbor tugs, to be known as type A tugs, of suitable design and sufficient power so that not more than two of them will be required to handle the largest vessels using the canal. Mr. M. C. Furstenau, consulting naval architect and marine engineer, of Philadelphia, Pa., was engaged in July, 1913, to prepare general plans and specifications on which competitive proposals could be received. These plans and specifications were approved in December, 1913, and circular No. 819, inviting proposals on four steel tugboats for handling and docking vessels at the entrances to The Panama Canal, was issued by the Washington office on January 6, 1914.

In order to obtain foreign as well as domestic proposals on these tugs, on September 6, 1913, a circular letter was forwarded by the Washington office to the consuls general in London, Paris, Berlin, and Brussels, advising that it was the intention of the Isthmian Canal Commission to invite proposals in the near future on the construction of four tugboats of approximate dimensions and characteristics as outlined in the letter. The consuls general were requested to forward copies of this circular to prominent shipbuilding firms, to ascertain what foreign bidders would submit proposals when the formal invitation for bids was issued.

In view of the enactment of a new tariff law in October, 1913, it was necessary to ascertain what percentage should be added to bids of foreign manufacturers in comparing same with domestic bids received on the tugs, in order to carry out the provisions of law and executive order, as described on page 213 of last annual report, regarding foreign purchases. After consultation with the custom officials of the Treasury Department, and the legal officials of The Panama Canal, an amendment to circular No. 819 was prepared and issued under date of February 5, 1914, from which the following is quoted:

* * * a material reduction in the tariff has been made by Congress. It is now thought that the amount equivalent to duty which should be added to the prices

submitted by foreign bidders when comparing bids with prices submitted by American firms will not amount to more than 15 per cent.

Bidders are warned, however, that the above percentage is based on the information obtainable at this time and the final percentage used in canvassing bids may vary therefrom.

An amendment was also issued in February, 1914, calling for proposals on two tugs in addition to the proposals on four tugs originally requested.

The following bids were opened in Washington on March 23, 1914. As it was decided preferable to accept delivery of these tugs at Colon, the bids submitted for delivery at builders' yards are not shown in the following table except in cases where no bid was made for delivery at Colon:

	Point of delivery.	Price per tug.	Time of delivery.
N. V. Industriele Handel Maatschappij, Rotterdam, Holland.	Colon.....	\$128,350	First tug, 340 days; second tug, 440 days.
Staten Island Shipbuilding Co., Port Richmond, N. Y.	do.....	152,000	First tug, 255 days; second tug, 285 days.
John A. Thornycroft & Co. (Ltd.), Southampton, England.	do.....	153,551	First tug, 310 days; second tug, 340 days.
Charleston Navy Yard, Charleston, S. C.....	do.....	155,712	First tug, 220 days; second tug, 250 days.
Puget Sound Navy Yard, Bremerton, Wash.....	Builder's yard....	157,600	First tug, 400 days; second tug, 420 days.
Maryland Steel Co., Sparrows Point, Md.....	do.....	158,000	First tug, 245 days; second tug, 275 days.
Nordseewerke, Emden, Germany.....	do.....	159,000	First tug, 450 days; second tug, 480 days.
Portsmouth Navy Yard, Portsmouth, N. H.....	do.....	160,901	First tug, 16 to 18 months; second tug, 17 to 19 months.
Pusey & Jones Co., Wilmington, Del.....	Colon.....	166,000	First tug, 220 days; second tug, 250 days.
Seattle Construction & Dry Dock Co., Seattle, Wash.	Ancon.....	210,700	First tug, 400 days; second tug, 400 days.

The two lowest bidders were the N. V. Industriele Handel Maatschappij, Rotterdam, Holland, whose bid, without duty, was \$122,350 on each tug, plus \$6,000 for delivery at Colon, or \$128,350 for each tug, delivery at the Isthmus. Including the assumed 15 per cent equivalent of duty, the amount of the Holland firm's bid was \$147,602.50 for each tug, complete, delivered at the Isthmus, or a total of \$295,205 for two tugs. After the proposals were opened, the above firm offered to reduce the time of delivery to 300 days for the first tug and 330 days for the second tug.

The lowest domestic proposal was submitted by the Staten Island Shipbuilding Co., Port Richmond, N. Y., which company bid \$152,000 on each tug, complete, or a total of \$304,000 for two tugs delivered at Colon. The dates of delivery were specified as 295 days for the first and 325 days for the second tug.

The bid of the Holland firm, including 15 per cent added for duty, was \$8,795 less than that tendered by the Staten Island Shipbuilding Co. Without taking the amount of duty into consideration, the bid of the Holland firm was \$47,300 lower than that of the Staten Island Shipbuilding Co.

The question of award was referred to the Secretary of War on April 23, 1914, who, with the approval of the President, made the award to the Staten Island Shipbuilding Co., and contract was entered into with that company on May 8, 1914, for the construction

of two tugboats at \$152,000 each, complete, delivered at Colon, the first on or before January 18, 1915, and the second on or before February 17, 1915.

Award was made on two rather than on four tugs, because it was thought that these tugs, with The Panama Canal tugs now engaged on construction work, will answer requirements for the present, and meanwhile experience will be gained from the use of these two tugs that will be valuable in making any additional purchases in future.

Dimensions of tugs.—The tugs will have single screw propellers and their principal dimensions are to be as follows: Length over all, 125 feet 6 inches; length between perpendiculars, 112 feet; breadth on deck, 30 feet; depth molded, low point, 17 feet; mean draft, loaded, 13 feet 3 inches; normal speed, 13 knots.

Hull and machinery.—The hull and machinery will conform in every respect with Lloyd's Rules for vessels of this special class, and all materials used in the same must be equal to that prescribed in the said rules. Each tug will be fitted with up-to-date fire-fighting apparatus.

Boilers and engines.—Each tug will be equipped with two 12 feet 6 inches by 12 feet single-ended return tubular cylindrical boilers of the Scotch type, each having two 44-inch corrugated Morrison furnaces. The boilers will be built for a working pressure of 150 pounds per square inch, and will be arranged to burn both coal and fuel oil.

Each tug will be furnished with one vertical inverted compound surface condensing engine of standard marine design, having cylinders 24 inches and 50 inches, by 30 inches stroke, and capable of developing not less than 1,000 indicated horsepower at 100 revolutions, with a steam pressure of 150 pounds at the boiler, without the use of by-passes. Each engine will be fitted with an independent surface condenser and independent air pump.

The boilers and engines will conform in every respect with the requirements of Lloyd's Rules and the United States Steamboat Regulations, and have been designed with a view to serviceability and low cost of maintenance combined with large boiler and engine power.

Inspection.—The inspection of these tugs is being performed by the Washington office, Mr. Furstenau having such general supervision of the construction and the inspection as is required by his contract.

CONSTRUCTION WORK—PACIFIC TERMINALS.

During the year Superintendent J. A. Walker has been in local charge of construction work performed by the subdivision of Pacific terminals at Balboa, with Assistant Engineer H. D. Hinman as his principal assistant.

The work of this subdivision includes everything pertaining to the construction of the dry docks, entrance basin, Balboa coaling plant, shops, yards, quay walls and pier, and the maintaining of dikes for the filling in of land resulting from the operation of dredges.

On January 1, 1914, excavation work in Sosa Hill to furnish rock for Naos Island Breakwater was transferred from the fourth division to this subdivision. In the latter part of the year there was transferred to this subdivision, as stated hereinbefore, the operation of Ancon Quarry and Miraflores sand service.

PACIFIC TERMINAL CONSTRUCTION.

General.—During the year 1,513,048 cubic yards of material were excavated, the greater part of which was for the dry docks, entrance basin, coaling plant, shops, quay walls and piers. Of this amount 1,477,843 cubic yards were placed in fills and embankments, the remainder being hand excavation wasted in the excavation of foundations for shops and orange peel excavation thrown to one side during the excavation for foundations for wharves and piers. Six hundred and eight thousand three hundred and fifteen lineal feet of holes were drilled and 217.66 tons of dynamite used in connection with this work; 42.5 miles of track were laid and 30.5 miles removed in connection with this work; 77,845 cubic yards of concrete were placed, in which there were used 11,041,572 pounds of reinforcing steel and 1,192,990 pounds of fixed steel; 202,223 lineal feet of piles were driven in connection with foundations and with trestles. Tables Nos. 11 to 17, inclusive, show the quantities of the above-mentioned items by months.

Steam shovel excavation.—Excavation by steam shovels was under the immediate direction of Mr. J. A. Loulan, superintendent of excavation. Steam-shovel work was performed for the dry docks, entrance basin, coaling plant, and at Sosa Hill and Diablo Hill. The maximum number of shovels in operation at any one time was nine.

Seven thousand nine hundred and thirty-nine cubic yards of earth and 129,837 cubic yards of rock were excavated for the Naos breakwater and Balboa dumps from Sosa Hill by this subdivision. Prior to the taking over of the Sosa Hill work by this subdivision, 95,200 cubic yards of rock were loaded by the fourth division during the months of November and December.

During the year 228,290 cubic yards of earth and 5,103 cubic yards of rock were excavated by this subdivision in Diablo Hill. This material was used in connection with the construction of the cofferdam, the fill round the shop yard, and the fill for the Panama Railroad yards. Repairs to steam shovels were made by the mechanical division.

Table No. 18 shows the total amount of excavation performed by steam shovels during the fiscal year.

Cofferdam.—The cofferdam, which was begun on April 1, 1913, to protect the entrance of Dry Dock No. 1, Dry Dock No. 2, the entrance basin, and the coal pocket excavations was located to include behind it as much of the rock excavation as possible.

A portion of the double track trestle which was first built gave way on the outer side on July 26 after dumping on each side for a few days. The outer toe was reinforced by dumping material on it from dredging scows. In view of the depth and the slope of the rock this trestle was replaced with a single trestle driven farther inland where conditions were more favorable and less fill would be required. The new trestle gave no more trouble with the exception of one small movement at the east end which made it necessary to drive a single trestle about 200 feet in length nearer the shore and close to site of the north wall of proposed Dry Dock No. 2. Rock fill was then dumped on the harbor side of the trestle and clay fill was placed on the inner side and supported by unloading loose rock on its outer face as the clay fill was advanced. As the fill approached

the top of the trestle at elevation plus 16, clay was used entirely. Along a portion of the inner side of the cofferdam it was reinforced with a riprap wall to prevent washing during heavy rains. After the trestle fill was completed, the center half of the cofferdam was widened out by dumping clay fill on the outside in order to permit as much material as possible to be excavated on the inside in the dry.

There has been very little or no seepage through the cofferdam. About the only leaks which have developed during the year have been through an old French fill, composed of loose earth and rock at the south end of the cofferdam. These leaks have not caused any embarrassment to the work.

One hundred and three thousand one hundred and sixteen cubic yards were placed in the cofferdam. Cross sections show that the earth fill has, since work started, pushed the overlying mud on the rock bottom out into the harbor about 200 feet. This was mainly due to the fact that the rock bottom directly outside of the cofferdam fill has a steep slope toward the harbor.

Dry Dock No. 1.—Excavation was carried on in Dry Dock No. 1 in conjunction with the excavation in the Coal Pocket, Entrance Basin, and Dry Dock No. 2 along the general lines laid out at the beginning of the work.

The old Balboa machine shop, which stood on the site of the north wall of the dock, remained on this site until the middle of November, 1913, and this confined the excavation along this side of the dry dock considerably, the work proceeding along the center and south sides. At the end of November, upon the demolition of this building, the last obstruction on the site of the excavation was removed.

The excavation from this area has nearly all been taken out from the dry-dock site in Lidgerwood and steel dump cars on a 3 per cent incline running along the north wall of the dock. This incline extends eastward between the foundry and the lumber shed and the permanent shop buildings.

Up to February, 1914, three shovels were worked eight hours a day. On February 5 the shovels were put on a 12-hour basis and another shovel was added. These shovels were worked on split shifts, 12 hours a day continuously, to the end of the year. One shovel was removed in June.

There were excavated from the site of Dry Dock No. 1 during the fiscal year 358,282 cubic yards, 48,838 cubic yards of which were classified as earth and 309,449 as rock excavation, making a total of 466,975 cubic yards excavated in Dry Dock No. 1 at the close of the fiscal year. There remains to be excavated about 87,000 cubic yards, and this excavation is mainly rock and is nearly all required for the culverts in the side walls of the dock.

At the close of the year the excavation under the south wall and over the south half of the floor was down to elevation minus 40. This is the grade of the floor, but is 14 feet above the elevation to which the excavation is to go for the culverts and the walls. The material was taken out of the dry dock, on both Lidgerwood cars and dump cars, most of the spoil being wasted either on the dumps at Balboa or on the Naos Breakwater. The rock walls on the north and south side of the dry-dock site have been kept as vertical as possible. The dip of the rock made it difficult on the south side of the dry-dock site to maintain a vertical face.

Water entering the excavation has been allowed to flow by gravity into the entrance basin where the drainage pumps are located. No trouble has been experienced from seepage or rain water flooding the work.

Toward the end of the fiscal year arrangements were made to provide means of removing the incline on the north side of the dry dock, and this will be done by building an incline on a trestle down from the head of the dock along its center. The material remaining will be hauled out on cars by locomotives on the trestle, which will be built on a 5 per cent grade. About 15,000 cubic yards will be taken up the wooden incline. The incline will facilitate the handling of cars, ironwork, and other material in and out of the site.

The concrete mixing plant will consist of 2-yard mixers placed under overhead bins in the south wall of the dock and 36-inch gauge Porter locomotives for transporting the mixed material to the forms in 2-yard bottom-dumping buckets handled by locomotive cranes with long booms.

Dry Dock No. 2.—Dry Dock No. 2, just north of the entrance to Dry Dock No. 1, was excavated during the year in connection with the excavation over the general area. The work was handicapped in this area due to the old shipways shop, which was run by the sixth division in connection with repair work on dredges. This building was not removed until January, 1914. The excavation for this dock was completed as far as excavation in the dry could be made behind the cofferdam and was carried to elevation minus 24. This material was handled very easily in connection with the material excavated from the general area. It is not proposed to continue work on this dry dock at present.

There was excavated from the site of Dry Dock No. 2 and the entrance pier on the south side of this dry dock during the year 41,548 cubic yards of earth and 52,129 cubic yards of rock. This material was removed by steam shovels and was taken to the dumps, using the incline running out of Dry Dock No. 1. Steam shovel excavation for Dry Dock No. 2 was completed at the end of May, 1914.

Entrance basin.—Work proceeded in the entrance basin throughout the entire fiscal year in conjunction with other steam shovel excavation in the immediate vicinity. Steam shovel operations in this area deepened the excavation from minus 13.5, at the beginning of the year, to the final grade, minus 45, for the entire area inside of the toe of the cofferdam, and a total of 351,333 cubic yards were removed. The rock of the area was nearly uniform and nearly all a hard blue andesite, with the exception of a few small seams of rotten yellow rock.

Two 14-inch electric pumps which were installed last year on the coaling plant site were removed to a final location adjacent to the inner toe of the cofferdam as soon as the excavation had reached minus 18, the bottom of the coal pockets. As the excavation proceeded the pumps were lowered. The operation of the two 14-inch electric pumps was not satisfactory, due to the 60-foot head under which they had to work. The pumps had been used for some time on other work and were not in good condition. In May these pumps were replaced by three steam-driven compound reciprocating Worthington pumps, with 14-inch suction and 12-inch discharge. These pumps have proven exceptionally satisfactory.

Seepage into the cut was measured during the months of March and April by daily readings on weirs. The total amount pumped from the sump was measured by a Cippoletti weir. During March, when there was but little rain, the average daily amount of water pumped was 56,148 cubic feet, less than one-half of which was salt water. The salt water entered through an old French fill at the southwest end of the excavation. During June, an average rainy season month, 3,710,266 cubic feet of water was pumped.

All the excavation for the entrance basin was completed at the close of the fiscal year, all material having been taken out on the incline along the north wall of Dry Dock No. 1.

BALBOA COALING PLANT.

Excavation.—The area required for the storage of coal and for the travel of unloading towers measures 800 feet in length—from station 0 to plus 8—and about 400 feet in width, measured from the outer edge of the quay wall. Between stations 0 and plus 2 and between stations plus 5 and plus 8, 500 feet in all, the bottom of the coal pile will be at elevation plus 10. Between stations plus 2 and plus 5, a distance of 300 feet, the bottom of the coal pile will be at minus 18 to provide for submerged storage of coal for military use. Excavation was performed by steam shovels and was practically completed in February, 1914. The amount excavated during the year was 166,104 cubic yards, 79,837 cubic yards of which was earth and 86,267 rock.

Concrete.—Upon completion of the excavation, work was begun on placing the masonry forming the crane runway supports which run east and west through the center of the storage pile and which support the old Pacific division berm cranes which will be reerected to rehandle the coal. This material was mixed by a $\frac{1}{2}$ -yard mixer and placed by a locomotive crane. At the close of the fiscal year all but three of the piers over the deep coal pockets were up to the construction joint where the girders which carry the rail are to be set. The retaining wall between the high and low storage pockets, at station plus 5, was up to elevation 12 for three-quarters of its length. The rubble retaining wall on the south side of the low storage area was completed, as well as a part of the small rubble retaining wall at the east end of the high area. There were placed during the year 3,950 cubic yards of concrete and 808 cubic yards of rubble masonry.

FILLING AND EMBANKMENT.

Excavated material removed from the general site of the dry dock was used to bring the shopyard up to elevation plus 18 and to make the fill behind the quay wall, piers, and the area to be occupied by the Panama Railroad yards, which lie east of the head wall of the permanent piers. When this fill had neared completion the excavation in Sosa Hill was shut down and the material from the dry dock was used for this purpose.

Very little fill remains to be done to bring the site up to the required grade in the vicinity of the shops and yards. The principal remaining fill at the close of the fiscal year is that at the west end of the coaling plant, a small quantity behind the head wall of Pier No. 1, and behind wharves "d e" and "e f."

QUAY WALLS AND PIERS.

The quay walls and piers under construction during the year consist of a reinforced concrete deck supported by cylinder piers sunk to rock. The concrete placed in these structures consisted for the caisson filler of a mixture of one part cement, three parts sand, and six parts broken stone; and for the reinforced concrete girders and floor slabs one part cement, two parts sand, and four parts of broken stone. Progress in caisson operations are shown in Table No. 19.

Quay wall "g h i."—The work on the substructure for this dock consisted of sinking cylindrical concrete caissons to rock and reinforcing and filling them. All reinforced concrete cylinders are 7 feet 6 inches in diameter, with 8-foot bottom section 5 feet in length. Sixteen caissons remained to be sunk during the fiscal year, most of the substructure having been completed last year. There are a total of 135 caissons in this dock, which required 8,819 cubic yards of excavation and 7,924 cubic yards of concrete.

The placing of the superstructure, consisting of reinforced concrete girders, beams, and floor slab, and a vitrified brick surface, began in July. An elevator tower, on a movable platform equipped with revolving chute having a universal joint, was used. One of these towers was placed at each end of the dock and worked toward the center. The reinforced concrete floor was completed February 1, 1914. It contained 7,146 cubic yards of reinforced concrete. The paving brick on this dock was laid on a sand cushion. There were 75,683 square feet of brick laid on the floor of this dock and it was completed on April 1, 1914.

A "deadman" was placed in the ground about 85 feet behind the rear edge of the dock and opposite each transverse girder, with an effective bearing area of 48 square feet, constructed of reinforced concrete. These "deadmen" are connected to the dock by steel rods $2\frac{3}{4}$ inches in diameter, drawn tight by means of turnbuckles. These rods were attached to the transverse girders and the rods were covered with concrete, forming a permanent anchorage to counteract the outward pressure against the cylinders.

Bulkhead quay wall "i j m n."—This wall is similar in construction to quay wall "g h i" described above, and forms the head wall to the slips on either side of Pier No. 1 which extends out from the face of this wall 1,000 feet at right angles to the canal and is 201 feet wide. The sinking of the caissons for this section of quay wall was completed in February, 1914. Rock was encountered very much higher than on the greater part of the other quay walls and it was necessary, therefore, to do considerable rock excavation in the caissons to get them well below minus 45. Most of the earth excavation inside the caissons was done by orange peel buckets operated on locomotive cranes. The only hand excavation necessary was in removing the rock and cleaning out the bottom of the caissons preparatory to placing the concrete filling.

Sixty-five 7 foot 6-inch piers were required for this dock. They were all sunk to rock at the end of February, 1914. The caissons had a total length of 3,699 linear feet. Three thousand four hundred and ten linear feet of caissons were sunk during the year. The superstructure was placed similar to that of the other docks by means of

movable towers and chutes. Two thousand four hundred and eighty-three cubic yards of concrete were placed during the year.

Pier No. 1.—The construction of Pier No. 1 has proceeded during the year in a manner similar to that of the other quay walls, both as regards excavating the caissons and placing the superstructure. Most of the material excavated was soft alluvial mud, but at the east end near the head wall rock was encountered at a relatively high elevation which necessitated considerable handwork. This hand excavation was removed in buckets by means of small hoisting engines rigged on "Star" well drills.

Work on sinking caissons began the latter part of February, 1913, and was completed in February, 1914, 14,637 lineal feet of penetration having been made with the 7-foot 6-inch diameter caissons. One hundred and eighty-four piers were sunk to rock during the year. Some difficulty was experienced at the outer end of the pier in holding the caissons in a vertical line. The material found at the bottom of the caissons was a mixture of sand and alluvial deposit, with decayed vegetable matter, such as logs and other debris. The caissons were sunk by loading them with cast-iron weights.

The superstructure of Pier No. 1 consists of a quay extending round the entire outer edge of the pier, and was begun in March and, at the close of the year, 1,548 linear feet of this wall had been constructed, containing 10,222 cubic yards of concrete. The reinforced concrete floor was nearly completed at the end of the year.

Quay wall "e f."—The work was begun on this section of quay wall at the east end, and a double trestle was constructed longitudinally through the site to be used for handling 6-foot steel caissons. As this work is in water, the reinforced concrete caissons used on the other dock work could not be used. The material for the caissons has all been ordered and fabricated and active operations have been going on in the construction of the dock since January.

The sand-unloading cranes, formerly used by the Pacific division, had to be moved off the dock, on which they had been working for the past five years, and that portion of the dock removed which interfered with quay wall "e f." A ladder dredge was put to work to clear the site. The excavation inside the cylinders has been performed by orange-peel buckets as much as possible, but the material overlying the hard rock is so firm that the greater part of the excavation has to be done by hand, using "Star" well drills as hoisting engines.

The upper sections of steel caissons on each pier have been designed so as to permit the salvage of the portion of the steel caisson shell above the mud line. Up to the end of the year very little work had been done in connection with the removal of these sections, but arrangements were under way and a diving bell has been constructed to be operated from a locomotive crane to permit the removal of the sections after filling.

The total penetration of caissons on this section of quay wall was 843 linear feet. Twenty-three caissons had been sunk to rock; 1,487 cubic yards of concrete were placed in the caisson shells.

A contract was let to the United States Steel Products Co. on May 16, 1914, for furnishing 1,500 tons of steelwork for the superstructure, at a total price of \$58,800, delivered at Colon on or before September 13, 1914.

SHOPS.

Work on the foundations for the various shop buildings had been well advanced at the end of last fiscal year. Work on the remaining foundations was pushed rapidly in order to have the foundations ready for the steelwork furnished by the United States Steel Products Co. Three thousand two hundred and twenty-one cubic yards of concrete were placed in these footings during the fiscal year. A detailed statement of the concrete placed by month in the various shop-building foundations is shown on Table No. 20.

All the shop area has been brought up to grade and surfaced with crushed stone, excepting the space occupied by the incline from the dry-dock excavation and a small area between the roundhouse yard and the foundry. The main work in connection with foundations has been on the north ends of buildings Nos. 1, 2, and 3, and also on foundations of buildings Nos. 5, 6, 7, 9, and 15, including the turntable pit, ash pit, and oil cranes. The foundations at the north end of buildings Nos. 1 and 2 were delayed on account of the necessity of maintaining rail connections to the sand wharf, for the use of the fifth and sixth divisions. The foundations in this area consist of 3-foot and 4-foot steel cylinders driven to rock and filled with concrete. A great deal of trouble was experienced in placing these foundations, due to obstructions in the mud below low tide, consisting of old barges and other French equipment and old metal which had been dumped into the area and covered up. The cost of the work was also increased from the fact that most of it was "tide work."

The foundations for the shops office building No. 28 were completed during the year. This work required 526 piles and 1,196 cubic yards of concrete.

Pipe piles and reinforced concrete piles were used in the foundations for the roundhouse, the turntable and ash pits. Similar piles were also used for some of the larger machine foundations.

The United States Steel Products Co. followed close behind the completion of the foundations and, as soon as their work was done, work was begun on the cinder floors, concrete floors and wood block floors in the buildings. The wood block floors, which were laid in buildings Nos. 1 and 8, have given some trouble due to expansion. The walls of the toilet buildings are built of hollow tile and finished with stucco, the gable ends being stucco and metal lath.

Machine foundations.—The installation of the machine foundations in the various buildings progressed rapidly as soon as it was possible to start work inside the buildings. On March 1, the machine footings of the principal shop buildings had been placed and a large proportion of the machines which were brought from the various shops on the Isthmus, or bought new in the States, had been placed in their permanent positions; 4,944 cubic yards of concrete were used in the construction of the various machine footings.

Shops tunnel.—The shops tunnel, which runs through the buildings and yard parallel to the axis of the dry dock, was completed. The tunnel is founded on wooden piles. The installation of the air lines, water lines, steam lines and electric wires was made by the Mechanical Division.

Drainage.—In order to carry off water from the area on which the shop buildings have been built, blind drains have been placed under

the eaves of all buildings. These drains were constructed by excavating a trench and placing drain pipe in the bottom covering the pipe, and filling the trench with No. 1 Ancon rock. At the end of the year all the drains were installed, with the exception of those on the north side of the buildings Nos. 1, 2, 3, and 4. The drains in the immediate vicinity of the dry dock and incline will also be connected with the main sewer which will run round the dry dock, when the dry dock walls are completed. The working ground around the shop buildings has been covered to a depth of about 12 inches with broken stone, on which a top dressing of Ancon Quarry screenings has been placed.

Precise levels.—Precise level bench marks were established during the year in the area occupied by the shops. Trouble has been experienced by the settling of these bench marks due to the excavation in the vicinity and the heavy blasting.

PANAMA RAILROAD YARDS.

The new Panama Railroad freight yards, which extend from Diablo Hill to the foot of Sosa Hill, were practically completed at the end of the year. The fill and excavation for these yards was performed by this subdivision. Excavation from the inner harbor by suction dredges was deposited through pipe lines into the swamp lying between the site and the old Panama Railroad line. A considerable amount of dry fill was also used.

The Panama Railroad Co. supplied all the ballast and laid all the rail for these yards.

CURUNDU RIVER CULVERT.

A reinforced concrete culvert 325 feet 6 inches long was built across the north end of the Panama Railroad yards to afford a passage for the Curundu River. Rock was found about 40 feet below the surface of the swamp at plus 2, and it was therefore necessary to drive piles to carry the culvert. This culvert was heavily reinforced; 1,664 cubic yards of concrete were necessary for construction. At the outer end of the culvert a tidal gate was placed, hinged at the top.

RECLAMATION OF LAND.

The low, swampy area east of Balboa Terminals and north of Ancon Hill was raised to a higher elevation over a large part of its area by a hydraulic fill dredged from the inner harbor.

REMOVAL OF BERM CRANES FROM MIRAFLORES.

In April a small force started removing the berm cranes from Miraflores Locks. At the end of the year one crane remained, which was used for unloading sand from barges. These cranes will be reerected at Balboa at the coal-handling plant.

NAOS BREAKWATER.

The completion of the breakwater was turned over to the fourth division when the central division was abolished last October. Spoil from Culebra Cut was used until the Cut was flooded on October 10.

From that date until January 1 rock was excavated in Sosa Hill by the fourth division and used as fill. On January 1 the operation of the shovels in Sosa Hill was turned over to the second division, which on April 1 became the division of terminal construction.

In March the shovels in Sosa Hill were shut down, and since then material has been obtained from the dry dock and entrance basin. Table No. 21, which accompanies this report, shows the amount of material placed on the breakwater, by months, during the fiscal year, amounting to 681,827 cubic yards.

At the beginning of the fiscal year all the trestle had been completed to elevation plus 14 and had been filled in with the exception of 600 feet. The work this past year has consisted of filling in this 600 feet. Considerable trouble has been experienced due to sliding and spreading out at the bottom. Communication by rail has been maintained nearly continuously with Naos Island however. At the close of the fiscal year the average elevation of the breakwater was plus 18.5 and it has been finished to its full width. The average settlement during the last two weeks of the year was 0.075 foot, with the exception of one stretch about 600 feet in length, which settles about one-half inch per day. During a portion of the last three months of the year there was a settlement of about 2 feet a day at the south end of the breakwater immediately north of Naos Island. The settlement at the end of the fiscal year at this point had greatly reduced and amounted to about $3\frac{1}{2}$ inches per day.

ANCON QUARRY.

Ancon quarry was continued in operation during the fiscal year. It was operated by the fifth division from July 1, 1913, to February 1, 1914, when the fifth division work was turned over to the fourth division. The operation of the quarry continued under the fourth division until May 31, when it was transferred to the division of terminal construction. Supervisor James Dougherty was in local charge from November 1, 1913, until the end of the fiscal year.

Considerable trouble was experienced during the early part of the year when the drilling and blasting operations were going on on top of the hill from rocks falling on the steam shovel which was working under a bank about 280 feet high. The greater part of the work has been carried on on the upper level, which is over 400 feet above the crushers. Two shovels have been kept at the quarry during the year. Until May, 1914, it was necessary to run both shovels. Since that time one shovel has been operated and the other held in reserve.

In July, 1913, the bank under the crusher building gave way and threatened to carry away the lower part of the crusher building and conveyor. The material in the slide was excavated by steam shovel, working day and night shifts, and about 40,000 cubic yards were thus removed and hauled to Miraflores Locks for back filling and to Balboa town site. During this time the crushers were run 12 hours a day.

The crusher plant has been in operation practically continuously for the past fiscal year. The large crusher has been relined once, the main shaft changed twice, and the main eccentric has been changed twice in order to be rebabbitted. All the machinery and conveyor bolts have been renewed once and the rock screens have been renewed three times during the year. The work has called for a larger amount

of No. 2 rock than formerly, and the crushers have been arranged to crush the rock smaller, the screens being changed so that a greater percentage of No. 2 rock is produced. A statement of operations at the quarry, showing the excavation by months, the performance of the rock crushing plant, and the amount of drilling and power, is shown in Table No. 22.

SAND SERVICE.

The unloading of sand from Chame at Balboa was handled by the sixth division from July 1, 1913, to February 11, 1914, on which date the sand unloading cranes at Balboa were closed down owing to the necessity of moving them off the temporary dock on which they were installed in order to permit the beginning of work on the new concrete quay "e. f." Unloading operations were transferred to Miraflores on April 28, on which date berm crane F was put into service unloading sand from barges, this work being performed by the fourth division. This service was augmented by the use of a locomotive crane on May 1, and both locomotive cranes and the berm crane worked during May and June. On June 16 the unloading of sand was transferred to the division of terminal construction. The sand is loaded by the dredging division at Chame Point and transported to Balboa and Miraflores in barges by tugs.

The statement attached herewith, Table No. 23, shows the amount of sand unloaded each month. A total of 193,782 cubic yards was unloaded during the year.

PERSONNEL.

The average gold clerical force employed by this subdivision during the first six months of the fiscal year was 7.5 men with 20 silver assistants. During the last six months of the fiscal year there was an average force of 11 gold men and 25 silver assistants.

The construction force of this subdivision averaged 2,954 men per month for the first six months, ending December 31; 2,753 men per month for the period from January 1 to March 31; and 2,306 men per month for the period April 1 to June 30.

TABLE NO. 11.—*Statement of work done, Pacific terminals, July 1, 1913 to June 30, 1914.*

Month.	Material excavated (cubic yards).		
	Earth.	Rock.	Total.
1913.			
July.....	54,734	33,554	88,288
August.....	72,006	30,232	102,238
September.....	58,818	26,370	85,188
October.....	93,921	38,492	132,413
November.....	67,823	45,809	113,632
December.....	65,270	48,185	113,455
1914.			
January.....	75,721	92,731	168,452
February.....	65,105	133,916	199,021
March.....	63,374	130,317	193,691
April.....	7,103	106,358	113,461
May.....	31,510	85,121	116,631
June.....	1,744	84,834	86,578
Total.....	657,129	855,919	1,513,048

TABLE No. 12.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.
EXCAVATION BY STEAM SHOVELS.

[Cubic yards.]

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Dry Dock No. 1:													
Earth.....	6,000	3,250	1,179	21,415	8,104	4,104	2,062	1,852	867	54,004	24,697	50,183	48,833
Rock.....	17,917	23,649	22,338	19,910	18,224	5,317	1,868	23,440	47,893				309,449
Dry dock incline:													
Earth.....		4,307	965					131					5,273
Rock.....		1,500	51										
Entrance basin:													
Earth.....	2,365	3,000	2,401	21,157	21,130	23,054	24,677	2,453	1,156				101,393
Rock.....	6,247	3,680		11,106	9,616	18,490	22,344	31,786	32,675	28,440	52,417	33,139	249,940
Entrance basin incline:													
Earth.....	763	5,671	12,225	46									18,659
Rock.....			1,856										1,902
Coal pocket:													
Earth.....	18,056	9,428	5,640	15,566	12,117	6,384	5,645	4,120			2,881		79,837
Rock.....	9,000	700		3,810	13,758	20,710	18,599	7,424	1,834	1,259	7,832	1,341	86,267
Coal pocket incline:													
Earth.....													
Rock.....					850	728							1,578
Dry Dock No. 2:													
Earth.....						710	3,818	7,003	3,755	700	25,562		41,548
Rock.....						919	3,460	14,005	16,641	17,104			52,129
Pier between entrance basin and Dry Dock No. 2:													
Earth.....													1,670
Rock.....								3,341		4,822			8,163
Preparing site:													
South of dry dock, earth.....			1,969										1,969
South of dry dock, rock.....			1,058	950									2,008
West toe Sosa Dam for Pier No. 1, earth.....					5,615	240							5,855
East toe Sosa Dam for Panama R. R. yard, earth.....		4,573	477										5,050
Sosa Hill Quarry:													
Earth.....							7,241	698					7,938
Rock.....							44,960	51,829	33,048				129,837
Diablo Hill for Panama R. R. yard:													
Earth.....	19,763	32,289	24,932	17,420	7,451	22,320	21,246	36,817	46,052				228,290
Rock.....				2,130	460	1,520		993					5,103

TABLE No. 14.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

DYNAMITE USED.

[Pounds.]

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Preparing site.....	4,155		480				990				200		5,825
Dry dock, entrance basin, and coal pocket.....	27,030	29,960	22,575	18,735	26,050	22,260	37,208	35,193	39,555	47,852	47,694	25,718	379,830
Quay walls.....		220	300	77	60								379,657
Pier No. 1.....					900	397	280	110	180	48	56		1,971
Sosa quarry.....							22,261	11,924	13,000	40			47,225
Shops, sinking caissons.....		715	413	228									1,356
Shops, tunnel.....	330												330
Reclaiming land and ditches.....							1,820	636	540	798		2,982	6,776
Municipal department.....							25		25	15			40
Mechanical division.....		1,350	930	450	2,760	4,572	8,060	3,990	16,150	5,175			25
Diablo Hill.....													43,437
Total.....	31,515	32,245	24,698	19,490	29,770	27,229	70,644	51,853	69,450	53,928	47,950	28,700	487,472

TABLE No. 15.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

Month.	1913.				1914.				Total.			
	Piles driven.	Track laid.	Track re-moved.	Month.	Piles driven.	Track laid.	Track re-moved.	Month.	Piles driven.	Track laid.	Track re-moved.	Linear feet.
July.....	Linear feet. 44,939	Linear feet. 13,254	Linear feet. 5,470	January.....	2,400	Linear feet. 7,963	Linear feet. 2,870		202,223	225,019	161,606	
August.....	27,912	35,892	23,495	February.....	16,735	16,593	15,723					
September.....	13,949	25,174	16,325	March.....	2,625	23,365	15,675					
October.....	18,780	28,497	19,944	April.....	13,795	17,630	13,539					
November.....	10,382	15,270	13,244	May.....	13,569	14,814	13,483					
December.....	22,212	15,594	14,209	June.....	14,925	10,973	7,629					
				Total.....								

TABLE No. 16.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

REINFORCING STEEL.

[Pounds.]

Item.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Shop buildings.....	61,412	33,857	34,068	95,434	7,537	7,759	39,027	9,605	13,712	50,482	1,222	.....	354,115
Machine foundations.....	26,964	29,265	13,542	6,060	19,117	148,316	38,930	1,882	101,481	37,212	16,675	2,844	442,288
Shop tunnel.....	18,755	34,905	31,883	3,945	2,441	3,355	2,331	420	.....	.....	2,040	.....	100,075
Quay wall:													
"e f," substructure.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40,827	125,873	63,541	230,241
"g h i,"—													
Substructure.....	322,770	244,417	.....	470,027	.....	.....	.....	.....	.....	.....	.....	.....	1,037,214
Superstructure.....	51,069	108,640	690,296	.....	401,979	28,739	3,806	.....	.....	.....	.....	.....	1,284,529
Anchors.....	.....	.....	9,493	.....	12,746	1,122	.....	.....	.....	.....	.....	.....	23,361
Bulkhead "j m n,"													
Substructure.....	.....	10,500	.....	476,616	63,423	27,252	.....	223	9,008	83,003	178,946	39,203	587,022
Superstructure.....	.....	.....	.....	.....	.....	.....	22,226	141,297	30,610	2,766	1,600	3,600	495,285
Anchors.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,906
Pier 1, "j k l m,"													
Substructure.....	.....	.....	184,870	1,256,396	1,087,407	362,956	3,774	3,308	.....	461,350	652,107	1,056,865	2,898,711
Superstructure.....	.....	.....	.....	.....	.....	.....	.....	.....	368,500	5,071	.....	.....	2,538,822
Anchors.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,494	.....	5,071
Lumber dock anchors.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,494
Calson shells.....	158,576	66,202	156,466	158,885	70,693	75,403	19,360	.....	8,750	.....	49,643	47,639	705,585
Coal pocket.....	.....	.....	.....	.....	.....	.....	48,844	.....	170,656	.....	.....	.....	106,032
Curundu River culvert.....	.....	.....	.....	.....	.....	.....	.....	.....	1,161	.....	.....	.....	219,600
Pontoon bridge.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,161
Total.....	639,546	527,786	1,120,618	2,460,363	1,665,343	654,902	178,398	156,735	703,878	680,711	1,032,600	1,213,692	11,041,572

TABLE No. 17.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

FIXED STEEL.
[Pounds.]

Item.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Shops:													
Foundations.....	105,567	19,791	1,109	6,534	1,554	436	1,344	3,530	3,663	348	301	.....	143,977
Walls, beams, and roofs.....	.....	.....	42	130	184	66	18	10	.....	240	.....	96	786
Column guards and stairways.....	.....	.....	.....	.....	97	2,258	4,498	875	85	.....	.....	.....	7,813
Floors.....	.....	.....	17,141	.....	.....	331	5,161	15,480	.....	.....	.....	.....	38,113
Machine foundations and ash pit.....	3,155	3,426	8,274	4,464	6,699	234,074	25,294	5,368	37,295	10,328	35,917	1,853	426,147
Tunnel.....	2,200	20,148	8,366	2,565	233	490	.....	.....	.....	.....	227	.....	34,229
Docks:													
Quay wall "fg" anchors and fenders.....	.....	.....	.....	178,257	34,458	.....	.....	.....	12,120	.....	8,111	39,957	48,068
Quay wall "gh" superstructure.....	.....	.....	23,316	27,088	12,932	59,300	6,496	37,778	.....	.....	.....	304	225,139
Quay wall, anchorages.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	166,910
Bulkhead wall "lj in n"—	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Superstructure.....	.....	.....	.....	.....	.....	.....	.....	4,317	826	.....	600	600	6,343
Anchorages.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,948	8,441	25,389
Pier No. 1, superstructure.....	.....	.....	.....	.....	.....	.....	.....	.....	5,151	3,629	14,799	19,024	42,603
90-pound rail in shops.....	.....	23,820	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,820
Dcauville rail in shops.....	.....	3,653	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,653
Total.....	110,922	70,838	58,248	219,038	56,157	296,955	42,811	67,358	59,140	14,345	126,903	70,275	1,192,990

TABLE No. 18.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

PERFORMANCE OF STEAM SHOVELS.

Month.	Average number of shovels working.	Hours under steam.	Working hours.	Earth.	Rock.	Total.	Average per hour under steam.	Rainfall.
1913.				Cubic yards.	Cubic yards.	Cubic yards.	Cubic yards.	Inches.
July.....	4.77	992.00	431.08	46,947	33,164	80,111	87.50	4.22
August.....	4.81	1,000.00	483.17	62,518	29,529	92,047	105.37	6.74
September.....	4.92	984.00	480.67	49,789	25,303	75,092	76.31	9.01
October.....	4.85	1,048.00	483.17	75,558	37,961	113,519	108.32	10.33
November.....	5.70	1,048.00	558.92	57,114	102,238	159,352	97.66	9.30
December.....	4.35	800.00	502.58	56,812	47,684	104,496	130.62	3.72

1914.									
January.....	7.46	1,552.00	854.83	64,689	91,231	155,920	100.45	.30	
February.....	7.83	1,810.67	988.97	54,613	132,949	187,562	103.59	.00	
March.....	6.15	1,696.00	955.92	51,830	132,091	183,921	108.44	.00	
April.....	4.72	1,844.00	829.75	700	105,629	106,329	116.00	4.94	
May.....	4.03	1,352.00	746.80	28,443	84,946	113,389	88.35	8.16	
June.....	3.73	1,164.00	620.25	.....	84,663	84,663	72.73	7.25	
Total.....	5.27	14,790.67	7,936.11	502,961	817,340	1,320,301	99.61	63.97	

TABLE No. 19.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

PROGRESS OF CAISSON OPERATIONS.

	Penetration (linear feet).					Number of caissons sunk into rock.					Concrete in filler (cubic yards).				
	Quay wall "e f."	Quay wall "g h i."	Pier No. 1 "j k l m."	Quay wall "i j m n."	Total.	Quay wall "e f."	Quay wall "g h i."	Pier No. 1 "j k l m."	Quay wall "i j m n."	Total.	Quay wall "e f."	Quay wall "g h i."	Pier No. 1 "j k l m."	Quay wall "i j m n."	Total.
1913.															
July.....	.....	268	1,715	935	2,918	.....	12	15	6	33	.....	1,441	.....	.....	1,441
August.....	.....	101	1,910	587	2,598	.....	4	18	21	43	.....	1,554	.....	40	1,775
September.....	.....	.....	2,575	276	2,851	.....	.....	28	6	34	.....	238	.....	344	766
October.....	.....	.....	2,091	100	2,191	.....	.....	28	2	30	.....	477	.....	665	1,238
November.....	.....	.....	943	46	989	.....	.....	11	2	13	.....	288	.....	130	984
December.....	.....	.....	1,020	33	1,053	.....	.....	5	20	25	.....	33	.....	469	1,931
1914.															
January.....	157	.....	400	1,097	1,654	.....	.....	35	.....	35	.....	.....	4,534	.....	4,534
February.....	411	.....	237	336	1,024	15	.....	44	8	67	.....	.....	1,279	290	1,569
March.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,002	150	2,752
April.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	.....	1,798	140	1,938
May.....	87	.....	.....	.....	87	.....	.....	.....	.....	.....	604	.....	1,349	744	2,697
June.....	187	.....	.....	.....	187	8	.....	.....	.....	8	860	.....	288	10	1,158
Total.....	832	369	10,941	3,410	15,552	23	16	184	65	288	1,437	4,031	13,346	3,942	22,783

TABLE No. 20.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.

CONCRETE PLACED.

[Cubic yards.]

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Feb-ruary.	March.	April.	May.	June.	Total.
Shops:													
Foundation piers.....	715	210	200	334	45	36	918	378	135	221	29	.....	3, 221
Machine footings, including ash-pit pipe piles.....	455	543	235	416	212	1, 272	608	149	362	412	138	139	4, 944
Walls and beams.....	167	50	20	259	350	124	185	106	252	82	.....	4	1, 599
Floors.....	567	433	224	525	61	428	928	797	570	51	435	2	5, 019
Columns and pilasters.....	34	.....	33	71	18	35	106	141	45	1	.....	.....	484
Roofs.....	.....	.....	58	110	8	9	.....	58	320	95	.....	.....	658
Stairways.....	.....	.....	.....	.....	.....	2	14	5	.....	.....	.....	.....	21
Tunnel.....	489	786	665	287	68	103	19	187	9	20	55	.....	2, 688
Permanent drains.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	5	.....	12
Total, shops.....	2, 427	2, 022	1, 435	2, 002	762	2, 009	2, 776	1, 821	1, 693	889	662	145	18, 646
Docks:													
Quay wall—													
“e f,” substructure.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	604	860	1, 487
“f g,” anchors (lumber wharf).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44	48	92
Quay wall “g h i”——													
Substructure.....	1, 441	1, 554	238	477	288	33	.....	.....	.....	.....	.....	.....	4, 031
Superstructure.....	325	540	1, 846	2, 907	1, 204	226	30	63	5	.....	.....	.....	7, 146
Anchorage.....	.....	.....	43	9	45	36	28	52	.....	.....	.....	.....	213
Bulkhead wall “j m n”——													
Substructure.....	.....	40	344	665	130	1, 429	.....	290	150	140	744	10	3, 942
Superstructure.....	.....	.....	.....	.....	.....	.....	.....	536	180	781	500	486	2, 483
Anchorage.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	36	28	76
Pier No. 1——													
Substructure.....	.....	181	184	96	566	469	4, 534	1, 279	2, 602	1, 798	1, 349	288	13, 346
Superstructure.....	.....	.....	.....	.....	.....	.....	.....	.....	791	2, 574	2, 646	4, 217	10, 222
Caissons, reinforced shells.....	2, 021	2, 023	1, 857	1, 907	892	500	249	.....	.....	.....	.....	.....	9, 449
Total, docks.....	3, 787	4, 338	4, 512	6, 061	3, 125	2, 693	4, 841	2, 220	3, 728	5, 328	5, 917	5, 937	52, 487
Coal pocket:													
Retaining walls and copings.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	279	543	508	1, 330
Berm crane piers.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	428	1, 040	1, 479
Berm crane foundations.....	.....	.....	.....	.....	.....	.....	.....	.....	370	771	.....	.....	1, 141
Total.....	.....	.....	.....	.....	.....	.....	.....	.....	370	1, 061	971	1, 543	3, 950

Curundu River culvert.....							96	454	499	615			1,664
Pontoon bridge, Paralso.....									192				192
Miscellaneous: Bench mark and temporary machine footings.....		33									3		36
Total concrete.....	6,214	6,360	5,930	8,063	3,887	4,702	7,718	4,495	6,432	7,893	7,553	7,630	76,977
Cinder concrete—Quay wall “g. h. 1” superstructure.....					400	391			77				868
Miscellaneous: Rubble masonry, coal-pocket walls.....												50	805
Rip rap.....													74
Coal pocket.....										346	297		196
Cofferdam.....	362	174	421				84		50	24			1,049
Dry-dock incline.....				92					112				
Total.....	362	174	421	92			84		277	370	297	50	2,127

NOTE.—Reinforced concrete caissons used on quay wall “g h i,” bulkhead wall “i j m n,” and Pier No. 1; 6 feet diameter steel cylinders on quay wall “e f.”

TABLE NO. 21.—Statement of material placed on Naos Island breakwater, July 1, 1913, to June 30, 1914.

Month.	Cubic yards.	Month.	Cubic yards.
1913.		1914.	
July.....	49,476	January.....	68,496
August.....	31,557	February.....	136,775
September.....	31,671	March.....	81,291
October.....	35,609	April.....	47,242
November.....	49,362	May.....	37,210
December.....	54,126	June.....	29,772
		Total.....	652,587

Total material dumped on breakwater to June 30, 1914, 2,117,000 cubic yards.

TABLE No. 22.—Statement of operations, Ancon quarry, July 1, 1913, to June 30, 1914.

Month.	Excavation.				Performance of rock-crushing plant.				Drilling and blasting.	
	Average number of shovels.	Rock.	Stripping.	Total.	Crushed rock.	Screenings.	Total.	Percentage of efficiency.	Linear feet drilled.	Dynamite used.
1913.										
July	2.55	Cubic yards. 32,925	Cubic yards. 18,484	Cubic yards. 51,409	Cubic yards. 31,891	Cubic yards. 2,942	Cubic yards. 34,833	0.7089	11,000	Pounds. 7,350
August	2.35	43,550	6,065	49,615	47,134	4,928	52,062	.7131	1,189	10,050
September	2.00	39,765	2,270	42,035	43,389	3,933	47,322	.7968	2,310	12,200
October	2.70	39,060	14,145	53,205	42,900	3,416	46,316	.7854	1,860	3,000
November	1.96	33,720	2,010	35,730	40,095	2,488	42,583	.7525	2,505	9,200
December	2.73	37,355	2,225	39,580	44,114	3,419	47,533	.8626	2,050	16,350
1914.										
January	1.27	43,160	1,565	44,725	50,862	4,443	55,305	.8686	1,650	18,200
February	1.04	41,880	.....	41,880	48,355	5,089	53,444	.8786	1,710	.....
March	1.00	43,430	3,305	46,735	49,487	5,148	54,635	.8480	2,820	1,100
April	1.00	40,380	.....	40,380	48,082	5,211	53,293	.8856	1,630	9,450
May	1.00	36,570	.....	36,570	42,898	4,037	46,935	.8683	2,250	11,800
June	1.00	42,480	.....	42,480	44,529	4,102	48,631	.8986	3,770	4,900
Total	1.72	474,275	50,069	524,344	533,736	49,156	582,892	.8142	34,784	103,600

In addition to dynamite shown above, 650 pounds black powder were used in December, 1913, and 600 pounds in January, 1914.

TABLE No. 23.—Statement of sand unloaded from barges from July 1, 1913, to June 30, 1914.

Month.		Cubic yards.	Month.	Cubic yards.
1913.		25,572	1914.	
July	.....	.....	January	21,900
August	.....	16,100	February	7,130
September	.....	18,650	April	3,150
October	.....	26,140	May	18,330
November	.....	19,950	June	21,140
December	.....	15,720	Total	193,783

TABLE No. 24.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914—Principal items of hand excavation.¹

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
SHOPS.													
Foundation piers:													
Earth.....	628	761	495	233	124	63	470	216	73	34			3,097
Rock.....		40	128	74		16	501		9	44			812
Machine footings:													
Earth.....	653	418	663	294	353	951	16	134	798	589	77	82	5,028
Rock.....			38	30	73				4	6	10		161
Shop floors (earth).....		3	33	30	33	18	86	987	50	628	91		1,959
Shop walls and beams:													
Earth.....		51	23	198	96	8							371
Rock.....				10									10
Shop drains (earth).....			205				593	540	1,450	1,237	1,211	72	5,308
Shop tunnel:													
Earth.....	475	2,167	1,100	405	716	175	45	155		241			5,479
Rock.....					50	25		137					212
Shop tracks, permanent (earth).....													75
Oil tanks (Sosa Hill) and office sewer:													
Earth.....			121	191									312
Rock.....			344										844
Total.....	1,756	3,440	3,150	1,465	1,445	1,251	1,711	2,169	2,384	2,779	1,389	229	23,168
DOCKS.													
Quay wall e f, substructure:													
Earth.....								123					123
Rock.....				83			117	298			60	171	729
Quay wall f g, anchorage (earth).....											793	145	938
Quay wall g h i, substructure:													
Earth.....	476	110						335					921
Rock.....	60	91											151
Quay wall g h i, superstructure (earth).....	289	729											1,018
Quay wall g h i, anchorages (earth).....			15	380	349	184	187						1,115
Bulkhead wall j m n (earth).....	79	254	216	112	6			69					1,735
Bulkhead substructure (rock).....	240	264	276	87	86	66	682	112					1,813
Bulkhead wall superstructure (earth).....								52					52
Bulkhead wall anchorages.....									36	60	55	30	181
Pier No. 1, substructure:													
Earth.....	178	196	232	267	115	245	100	137					1,470
Rock.....	90	308	281	241	363	394	200	410					2,287
Superstructure (earth).....								452	628	376	98	118	1,672
Removing dike.....		300											300
Total.....	1,412	2,252	1,020	1,170	919	889	1,286	1,987	664	436	1,006	464	13,505

¹ There was excavated 7,073 cubic yards on miscellaneous small jobs which are not shown in this table.

TABLE No. 24.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914—Principal items of hand excavation—Continued.

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
DRY DOCK.													
For drills:													
Earth.....						617	73	30	60	250	60	55	780
Rock.....													365
Incline ditches and incline bridge:													
Earth.....	295			50	149	45	96	20	40	80	45		695
Rock.....								10					135
Entrance basin sump and pump house (rock).....										314			314
Coal pocket, walls, floors, piers, etc.:													
Earth.....							658	790	1,647	1,259	285	955	5,594
Rock.....				761	153	56	83	25	341	35			376
Coal pocket, tracks, and test pits (earth).....							360			13			1,091
Cofferdam, earth sloping.....		326				576	111	102	533				686
Permanent yard tracks (earth).....				6,433	2,482	564			711	210			10,237
Curundu culvert (earth).....					986							900	3,371
Hydraulic dikes, cast up and from borrow pits (earth).....			93	2,685	2,464	2,633	6,095	4,010	1,094	1,030	430	105	20,639
Panama Railroad yard.....		200	547					82		130		125	872
Grading material and shop yard.....													212
Total.....	295	526	640	9,929	6,234	4,491	7,476	5,069	4,426	3,321	820	2,140	45,367

TABLE NO. 25.—*Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.—Pile trestles constructed.*

	For construction at quay wall. c. f.	For coffer- dam con- nection across Dry Dock No. 2.	Temporary trestle to transfer table.	Trestle No. 5, Curundu River.	Sixth division repair wharf extension.	Cofferdam and Comb- er's T wharf.	Panama R. R. southbound main line.
1913.	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>
July.....							
August.....							
September.....							
October.....						154	224
November.....							
December.....							
1914.							
January.....							
February.....				180	120		
March.....			80				
April.....	491						
May.....	214	130					
June.....	425						
Total.....	1,130	130	80	180	120	154	224

TABLE NO. 26.—*Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914.—Ditches dug.*

	Dry dock.	Entrance basin.	Coal pocket.	Building No. 2.	Building No. 3.	Building No. 4.	Building No. 8.	Total.
1913.	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>
July.....	3,640							3,640
August.....	2,000	1,600	1,250					4,850
September.....	1,180	960	1,670	600	730	600	810	6,550
October.....	670	1,120	2,100					3,890
November.....	430	1,005	2,700					4,135
December.....	310	1,650	3,000					4,960
1914.								
January.....	150	1,150	860					2,160
February.....	212	1,430	780					2,422
March.....								
April.....	450	730	200					1,380
May.....	100	810	360					1,270
June.....	500	1,300	280					2,080
Total.....	9,642	11,755	13,200	600	730	600	810	37,337

TABLE No. 27.—Statement of work done, Pacific terminals, July 1, 1913, to June 30, 1914—Miscellaneous.

	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Shop buildings (1:2 cement-sand plaster):													
10 per cent lime.....square yards.		504	324	36	936	2,256	1,944	2,232	5,640	25,488			13,872
Barrett roofing.....square feet.			27,216	156,960	183,610	864	15,120		2,400				411,658
Hyrb.....do.	720	470				351	1,588	4,587	6,013	81	1,296	3,430	18,536
Wire mesh.....do.	620	700	3,049	6,818	3,423	732	10,080	3,334	22,688	9,112	4,087	1,814	63,457
Expanded metal.....do.								1,620	95				1,715
Metal caging.....linear feet.					3,580	1,181	27,017	300	477	1,040			33,595
Wood blocks.....square feet.				9,828	10,492	14,517	2,210	8,154	5,444	50	770	171	51,636
Hollow tile.....do.	600	1,952	384	2,142	6,364	5,136	10,260	13,770	3,600	2,495	2,000		48,703
Copper flashing.....do.										600	102		702
Wire.....pounds.			400	1,300	500	1,950	2,000		500	500	2,800		9,950
Shop tunnel:													
G. I. pipe conduit.....linear feet.	380	520	180	278	63	40	12				40		1,513
Vitrified ducts.....do.	6,868	7,190	3,206	1,120	1,160	1,204		8,005		200			28,963
Waterproofing metal.....square feet.	694	956	285	435	87	24	8	1,000			74		3,563
Alum.....pounds.		25	100	148	20	50							343
Lye.....do.		9	20	49	4	10							92
Shop drains:													
Concrete pipe, 20-inch.....linear feet.								981	267				1,248
Tile, 18-inch.....do.										428			428
Tile, 15-inch.....do.										1,020	640		1,660
Tile, 10-inch.....do.									2,574	2,209	3,049	275	8,107
Tile, 8-inch.....do.								113		158		15	286
Ducts.....do.											112		112
Docks:													
Wire.....pounds.								1,100	800	2,600		3,400	7,900
Pitch.....barrels.								27	2		6		35
Curundu River culvert—Wire.....pounds.									900	400			1,300
Pontoon bridge, Paraiso—Wire.....do.									100				100
Coal pocket:													
Drains, 10-inch tile.....linear feet.											16		16
Drain ducts.....do.											15		15
Drain, 4-inch g. I. pipe.....do.										70	70	85	225

CONSTRUCTION WORK, PACIFIC TERMINALS, BALBOA TOWN SITE SUB-DIVISION.

Balboa town site.—On August 1, 1913, this subdivision was established with Landscape Architect W. L. Phillips in local charge of both design and construction work. The work assigned to this subdivision included the planning of the permanent town of Balboa, the design of the streets, water and sewer systems, and the construction thereof and the preparation of record maps and plans of this work. Additional duties were assigned to the landscape architect in connection with the planning of the permanent settlement at Pedro Miguel, the permanent silver settlement at La Boca, and for other work requiring the services of a landscape architect. The office of this subdivision is located at Balboa. At the end of the fiscal year the force included 18 gold employees and 208 silver employees.

During the year the following work was performed by this subdivision at Balboa:

The preliminary studies that had been made for the permanent town of Balboa were revised and used so far as considered desirable. Previous study had served to determine the location of the administration building, and the formal mall of buildings on Balboa Plain, as recommended by the fine arts commission. The street plan was developed about the central motive.

As laid out the main roadways have a width of 24 feet, and roadways of secondary importance have widths of either 18 or 14 feet. The land which had been set aside for the permanent gold site at Balboa includes the following three divisions:

First. An area of about 29 acres on the north and northwesterly slopes of Sosa Hill, which may be termed "Sosa Hill." As this tract is nearer to the shops and terminals, it has been proposed for their convenience to assign shop and terminal employees, so far as practicable, to quarters in this subdivision.

Second. An area of about $72\frac{1}{2}$ acres on the southwesterly slope of Ancon Hill, in which the administration building has been located, which has been named "Balboa Heights." This area includes about 28 acres of Ancon Hospital reservation, which were released by the health department. Included in the land released by the health department was the former site of Ancon Cemetery, about 4.4 acres in extent. The Governor's residence and the residences of married employees working in the administration building will be located in this area.

Third. An area of about 58 acres on the low ground between areas first and second, in which will be located buildings of a public and semipublic character, as well as quarters. This area has been termed "Balboa Plain." It was originally a tidal marsh, which was filled with spoil from Culebra Cut.

Construction work was started the latter part of August, 1913. The progress of town-site work has been governed, to some extent, by the existing structures, tracks, etc. It was found necessary, in order to secure suitable drainage, to raise the grade of about 20 acres of Balboa Plain, for which about 75,000 yards of dry fill were required. This fill, which had a maximum depth of 3 feet, was completed in April, 1914. Sewers and water mains, curbs, gutters and surface drains in the areas which were accessible during the year were practically completed in May. The making of sewer and water connections,

the laying of walks, the grading and planting of grounds around buildings has closely followed up the work of the building construction forces.

Drainage and sewerage.—Storm water is removed from the town site by a concrete box drain 5.5 by 8.5 discharging at elevation 0 into the cove east of dump No. 1. This drain divides near the old commissary at elevation plus 7.35 into a 4 by 4 culvert ending at the foot of the administration building hill and a 4 by 4 culvert ending near the new clubhouse. This work was started by the old fifth division and completed by the division of municipal engineering. Water is removed from the streets on Sosa Hill and Balboa Plain by means of storm-water sewers and concrete ditch-form gutters. In Balboa Heights storm water is removed entirely by means of concrete gutters.

Sewage from Balboa Heights and Balboa Plain is carried in a separate system to a point near the old commissary, where it discharges into the storm-water culvert at about the elevation of mean high water. Sewage from Sosa Hill is removed through the storm-water drains. All sanitary sewers have been designed to give a minimum velocity of 2.5 feet per second.

The drainage and sewerage installations operated satisfactorily to the end of the year; no nuisance has developed and no flooding or excessive erosion occurred.

Water supply and fire protection.—The water-distribution system forms a part of the general Ancon-Balboa-Panama system. Standard fire plugs as designed and furnished by the division of municipal engineering, and having 6-inch connections, have been located in accordance with the requirements of the division of police and fire protection.

Paving.—Extended consideration was given to the materials and methods of constructing the streets. Water-bound macadam has not proved satisfactory on the Isthmus, especially where there is any great amount of traffic, on account of its dust, raveling under traffic, eroding under rains, and the resulting high cost of maintenance. Its principal advantages are its low first cost, and that it requires no special plant to lay. In order to get the work started the streets on Balboa Plain were laid with water-bound macadam, with the understanding that, later on, asphaltic concrete or other form of bituminous surfacing could be applied when desired. Early in 1914 contract was placed with the McAleenan Bros. Co., of Pittsburgh, Pa., for an asphaltic concrete mixing plant for \$4,650, and the necessary asphalt was requisitioned in order to be able to make so-called "asphaltic concrete" by the proper combination of bitumen and crushed stone hot mixed by mechanical means before applying to the roads. On arrival of the mixing plant, in May 1914, it was erected on the first quarry level in Balboa Heights. The plant consists of a revolving-drum stone heater equipped with a $\frac{1}{2}$ -inch-high pressure oil burner, operating under a pressure of 150 pounds, which heats the stone to a temperature of 275° F., and from which a bucket conveyor raises the heated stone to an elevated stone bin, from which it is discharged, by gravity, into a measuring box and then into a $\frac{1}{2}$ -yard motor-driven Smith concrete mixer. The plant is equipped with two asphalt heaters, in which the asphalt is raised to a temperature of 350° F. The concrete mixer discharges the batches by gravity into 1 $\frac{1}{2}$ -yard bottom dump wagons. The asphalt was purchased under the following specifications:

Penetration, 45-55 (Dow machine). Paraffin, not more than 0.75 per cent. Solubility in chemically pure carbon bisulphide, 99.6 per cent. Ductility at 77° F., not less than 100 centimeters.

The mixture consists of 66 per cent No. 2 Ancon stone that passes through a 1½-inch mesh screen, 26 per cent of Ancon quarry screenings, and 8 per cent of asphalt. The asphaltic concrete, having an average depth of 2½ inches after rolling, is laid on a broken-stone base, about 6 inches thick after rolling, consisting of No. 1 Ancon rock, with enough No. 2 rock to fill the larger voids in the upper surface. The output of the mixing plant averages 22 cubic yards per day of eight hours. As this plant was not put into commission until the rainy season had started, a large proportion of the working time has been lost on account of shutdowns during rains. During a period of 14 working days, however, 2,048 linear feet of 18-foot road was completed, amounting to 4,096 square yards.

Light and power.—All light, power, and telephone cables in Balboa will be laid underground in conduits, the secondary distribution being effected through armored cable. This work is under the jurisdiction of the electrical division.

Location of subsurface structures.—The absence of private property together with a previous knowledge of where buildings were to be placed, has made it possible to locate practically all subsurface structures likely to need repairs, inspections, or replacing, elsewhere than under pavements, thus avoiding a common source of heavy expense in municipal maintenance.

Plant propagation.—The propagation of trees and shrubs for horticultural work on the town site has been carried on since November, 1913, by the health department at Corozal farm, in accordance with lists prepared by the landscape architect and Mr. Henry Pittier.

A table is attached showing the various items and amounts of work completed by this subdivision during the year.

Other work.—The plans for the permanent town of Pedro Miguel were worked out by this subdivision, and included the layout and design of new roads, together with additions to the water and sewer system. The plans were approved in August, 1913, and the construction was undertaken by the division of municipal engineering.

The services of the landscape architect have been used by various departments and divisions in connection with their work.

TABLE NO. 28.—Balboa town-site work completed during the fiscal year 1913-14.

Item.	Amount.	Item.	Amount.
Ditching.....linear feet..	3,920	Sewers:	
Excavation.....cubic yards..	80,199	6-inch.....linear feet..	7,679
Fill.....do.....	23,295	8-inch.....do.....	6,736
Macadam pavement.....square yards..	18,301	10-inch.....do.....	1,597
Asphaltic concrete pavement.....do.....	4,096	12-inch.....do.....	7,361
Gravel pavement.....do.....	1,078	15-inch.....do.....	1,326
Curbs.....linear feet..	13,142	20-inch.....do.....	1,099
Gutters.....do.....	7,067	24-inch.....do.....	1,079
Miscellaneous concrete.....cubic yards..	760	Concrete box drains, 3 by 3 feet.....	739
Water pipes in place:		Manholes.....	159
4-inch.....linear feet..	4,542	Rubble masonry.....cubic yards..	318
6-inch.....do.....	16,760	Trees planted.....	50
8-inch.....do.....	1,803	Grounds planted.....square yards..	370
Service water pipe in place:		Lawn seeded.....do.....	4,353
1-inch.....do.....	3,124		
1½-inch.....do.....	1,262		
2-inch.....do.....	988		

ATLANTIC TERMINALS—CONSTRUCTION.

General.—Upon the abolishing of the Atlantic division on February 1, 1914, the work connected with the completion of the west breakwater, the operation of Porto Bello quarry, and the construction of the east breakwater, was transferred to the division of terminal construction. Construction work connected with the Cristobal coaling plant, except dredging, is also being performed by the division of terminal construction.

Lieut. Col. William V. Judson, United States Army, as assistant division engineer, was in local charge of breakwater construction work until he left the Isthmus on leave of absence, effective January 23, 1914, at which time Asst. Engineer F. C. Stanton was placed in local charge of breakwater construction and Porto Bello quarry. In addition Mr. Stanton was placed in local charge of the Cristobal coaling plant work on March 2, 1914, when preliminary operations were begun on the site. On April 1, Mr. R. B. Tinsley was appointed as assistant engineer in local charge of the coaling plant construction. Asst. Engineer Tinsley left the Isthmus on May 3 and the coaling-plant work was combined with the breakwater construction under Asst. Engineer Stanton. On May 29, when Asst. Engineer Stanton left the Isthmus, the work in connection with the breakwater construction was placed in local charge of Supt. C. C. Snedeker, and Supt. W. G. Thompson was appointed in local charge of the coaling-plant work, both reporting direct to the engineer of terminal construction.

Breakwater quarry, Porto Bello.—The production of armor rock at the quarry continued during the fiscal year on the old crushed rock quarry level above the two lower levels referred to in the last annual report. On December 1, 1913, working hours in the quarry were reduced from 12 to 8 hours a day. On April 30, 1914, operations at Porto Bello ceased.

The equipment in service at Porto Bello for producing armor rock included two 300 class locomotives; eight 400 class locomotives; four model 91 Marion steam shovels; one 70 ton Bucyrus steam shovel; four locomotive cranes and one 70 ton steam shovel converted into a crane; two unloaders; two plows and spreader; and 75 Lidgerwood flat cars.

During the year, 207,654 cubic yards of armor rock were produced and shipped. Auxiliary excavation by steam shovels amounted to 302,893 cubic yards, which was wasted on the shore dump; 119.75 tons of dynamite were used; 94,741 linear feet of holes were drilled; 34,109 linear feet of track were laid, and 25,809 linear feet were removed.

During May, 1914, the quarry was closed down in such manner that it can be reopened if found necessary later in connection with the east breakwater. The following equipment was removed: Six locomotives; 1 steam shovel (the 70 ton Bucyrus) was sent to the obsolete storehouse; two locomotive cranes were transferred to Balboa and one to the division of fortifications; two locomotives, of which one was sent to the Cristobal coaling plant, and one was returned to the Panama Railroad.

Water transportation.—In connection with this service the tugs and other plants steamed about 17,851 miles, handled 1,615 barges, and

carried about 22,000 passengers. From February 19, 1914, to April 1914, 2,647,023 gallons of water were hauled from Cristobal to Toro Point in a specially prepared barge. There were regularly employed in this service one tug and nine stone barges; others were available in case of breakdown. In May, 1914, the tug and one of the barges were transferred to the dredging division; and eight barges were transferred to the Panama Railroad Co. In June, 1914, one crane barge was transferred to the supply department.

West breakwater, Colon.—Repair work on the breakwater trestle terminated on December 4, 1913, and all rails, stringers, and caps were removed and shipped to Coco Solo for use on the east breakwater. The piles from the harbor side of trestle near the water line were also removed.

The total amount of Porto Bello rock placed on the breakwater from July, 1913, to May, 1914, was 207,654 cubic yards, of which 169,442 cubic yards were placed by three derrick barges, and 38,212 cubic yards by three cranes; 18,254 cubic yards of dredged rock were placed in the breakwater; 800 linear feet of track on the trestle were relaid. The necessary maintenance work was done on pipe lines, reservoirs, and sewers.

The plant included 2 locomotives, 3 locomotive cranes, 23 Lidgerwood cars, 1 unloader, 2 plows, and 3 derrick barges.

Operations at Toro Point in May, 1914, consisted of placing 1,448 cubic yards of Porto Bello rock in the breakwater and in preparing the equipment for storage, with the exception of two locomotive cranes shipped to Dock 13, Cristobal, for use at the coaling station and east breakwater. One lathe was transferred to Balboa, the shop tools were removed to Coco Solo for use on the east breakwater, and two locomotives were sent to the obsolete storehouse.

The breakwater was completed in May, 1914. The time originally estimated for completion was July 1, 1914. Its cost was \$3,492,-781.27, which was less than was originally estimated. It contains 1,945,733 cubic yards of material, consisting of 669,254 cubic yards of dredged rock, 819,930 cubic yards of Toro Point rock, and 456,549 cubic yards of Porto Bello rock.

The following is a statement showing the unit cost of quarrying, towing, and the placing of large rock in the west breakwater for the fiscal year ending June 30, 1914:

Quarrying—Armor rock.

Month.	Monthly output.	Unit cost per cubic yard.		
		Operation.	Plant.	Total.
1913.	<i>Cubic yds.</i>			
July.....	23,772	1.7675	0.6523	2.4198
August.....	24,026	1.9054	.6523	2.5577
September.....	23,467	1.9131	.6523	2.5654
October.....	25,990	1.8572	.6523	2.5095
November.....	21,489	1.8168	.6523	2.4691
December.....	18,595	1.9195	.6523	2.5718
1914.				
January.....	17,888	2.1505	1.5846	3.7351
February.....	16,678	2.1570	1.5838	3.7408
March.....	21,220	1.2742	1.5842	2.8584
April.....	14,529	1.2249	.....	1.2249
	207,654	1.8028	.8570	2.6598

Towing—Armor rock.

Month.	Monthly output.	Unit cost per cubic yard.		
		Operation.	Plant.	Total.
	<i>Cubic yds.</i>			
July, 1913–May, 1914.....	¹ 207,654	² 0.1999	³ 0.1519 ⁴ 1.0066	1.3584

¹ Total output.² Tugs and barges.³ Maintenance of equipment.⁴ Plant arbitrary.*Placing large rock.*

1913.				
July.....	23,772	0.4922	0.2748	0.7670
August.....	24,026	.5046	.2748	.7794
September.....	23,467	.5836	.2748	.8584
October.....	25,990	.6026	.2748	.8774
November.....	21,489	.8153	.2748	1.0901
December.....	18,595	.6349	.2748	.9097
1914.				
January.....	17,888	.4709	.6507	1.1216
February.....	16,678	.5662	.6507	1.2169
March.....	21,220	.4214	.6507	1.0721
April.....	13,081	.7546	.....	.7546
May.....	1,448	3.0854	.....	3.0854
	207,654	.6107	.3566	.9673

East breakwater.—In accordance with instructions contained in letter of February 27, 1913, from the chairman of the Isthmian Canal Commission, preliminary investigations were made at Santa Rita Mountain, Cano Saddle, Agua Clara Valley, Mount Hope, Mile 23, and Mile 24½, Panama Railroad, with the object of locating core and armor rock suitable for use in the east breakwater. Work at Santa Rita and Cano Saddle was afterwards stopped, in accordance with instructions from the chairman. The Mount Hope and Agua Clara rock was found to be a soft, argillaceous deposit common in this vicinity, and the Mile 23 rock was very hard and small. The rock at Mile 24½ was most promising, and more complete investigations were made there. A report covering this work was forwarded to the chairman by the division engineer of the Atlantic division on January 22, 1914.

Surveys were made at Coco Solo for the general layout of the construction plant, where the shore connection with the construction trestle will be made. Preliminary work was performed during the year as follows:

Thirty-four and four-tenths acres have been cleared. A railroad connection has been completed between the root of the breakwater and the Margarita Point Railroad. Auxiliary lines and sidings are practically completed at Coco Solo Point, and one-half of the siding along the Margarita Point Railroad. A new connection, with a siding, has also been made at Mount Hope between the Margarita Point Road and the main line of the Panama Railroad; also a cut-off connection through the old Mount Hope quarry. In all, 5.2 miles of new track were laid. A dock 16 by 100 feet with trestle and track connections was built for the unloading of materials; 58,652 cubic yards of sand and coral were excavated by the dredge *Sandpiper* in the Coco Solo Harbor to afford a landing for launches and for tugs towing piles. A 6-inch water main was laid from the Margarita Point main at the

Coco Solo turnout. A 50,000-gallon storage tank has been erected for watering locomotives and for additional fire protection. Fire hydrants have been installed in the lumber and pile yards. Labor trains operate between Cristobal and Coco Solo, so that the only buildings which it was necessary to erect are an office, storehouse, machine shops, sawmill shed, and bunk house for watchmen. These buildings have been completed.

The railroad to Margarita point was repaired and ballasted. The Coco Solo yard was filled in to elevation plus 3.3 feet, and the approach tracks for trestle raised to elevation plus 14.5 feet. Practically all of these tracks have been ballasted. There have been placed 64,506 cubic yards of track fill; 11,512 cubic yards of gravel ballast, and 522 cubic yards of crushed rock ballast.

Wash borings and soundings are being made along the center lines of the breakwater site. This work is being done by United States floating pile driver No. 1, which has been specially rigged up for it. Twelve wash borings and 10 soundings have been made.

Before the east breakwater had been transferred to the division of terminal construction, the design of the trestles and the cross sections of the breakwater had been approved by the division engineer of the Atlantic division. The trestles are being built and the breakwater will be built in accordance with this design. Both the trestle and breakwater follow closely the design that proved successful in the construction of the west breakwater. The work involved in the east breakwater requires the construction of about 11,093 linear feet of double-track trestle. The breakwater, as originally approved, will be 7,200 feet long, its inner end being 3,893 feet from the end of the shore fill. The breakwater will require approximately 1,185,000 cubic yards of core rock and about 350,000 cubic yards of armor rock, or a total of 1,535,000 cubic yards of rock. Trestle construction was begun on March 2, 1914.

A single-track trestle along the center line of the breakwater was built to bent No. 63, when it was found that the material overlying the rock bottom was so soft that it became unwise to continue the single-track trestle. It was therefore deemed advisable to double track the trestle. Accordingly the double-track trestle was begun at bent No. 63, and a second single-track trestle was started from shore and parallel to the first track. On June 30, 1914, 1,755 linear feet of single-track trestle and 2,470 linear feet of double-track trestle had been completed. The station on center line of the breakwater at the end of the double-track trestle was 36 plus 83.

After the submission of comparative estimates of cost based on different sources of supply for the rock to be used as breakwater fill, it was decided by the Governor to obtain the rock from Sosa Hill quarry and transport it across the Isthmus. At the end of the year the force included 23 gold employees and 380 silver employees.

CONSTRUCTION WORK—ATLANTIC TERMINALS.

Subdivision of Cristobal coaling plant.—Drilling and blasting channel material in the vicinity of the coaling plant was started by the dredging division in July, 1913, and the removal of material by a pipe-line dredge—there being no ladder or dipper dredges available—was continued during most of the year. The dredge worked on the

deep coal pocket at the north end of the storage pile during the year, as well as on work connected with the making of a channel along each side of the coaling plant. The dredged material was pumped ashore where most needed. The material, being largely clean coral rock and sand, has been used to bring the area in which coal will be stored in the dry, measuring about 300 feet by 1,200 feet, up to elevation plus 2. It has also been used in making fill behind the concrete walls carrying the tracks for the stocking and reclaiming bridges in the southerly 700 feet of the plant. The preliminary construction work accomplished includes erecting the following buildings on the ground at the site on Mindi Island: Office, carpenter shop, small repair shop, storehouse, and air-compressor house. A 550-foot electric-driven air compressor supplies power for riveters and also to pumps and other small equipment. A 4-inch water main was run from Mount Hope. Telephone communication was established and a system of fire protection installed.

Tests were made on the bearing power of the coral fill by loading wooden tables that had a bearing area of 4 square feet up to 5 to 6 tons per square foot. These tests showed that the fill could carry up to 1½ tons per square foot without appreciable settlement. Work was pushed on the construction of the trestles for use in setting the 6-foot caissons and on the construction of the two concrete walls supported on piles, about 700 feet in length, that carry the tracks for the stocking and reclaiming bridges. At the end of the year the trestle construction was about 25 per cent completed. Pile driving in foundations of bridge tracks and viaduct posts was completed except for foundations of certain viaduct posts on the west side and also at the two south corners, where final locations had not been fixed. Fifty per cent of the concrete for the foundations of bridge tracks and viaduct posts was completed. Setting and driving of 6-foot steel caissons for the wharf was proceeding satisfactorily; at the end of the year 78 cylinders had been set. Six of these were driven to rock with a steam hammer in advance of any excavation. No caissons had been sunk in deep water at the end of the year. On June 30, 1914, the force included 41 gold employees and 447 silver employees.

The following is a general statement of work accomplished and material used:

Construction trestle:

Length of piling used.....	feet..	20,799
Length of trestle to July 1, 1914.....	do...	1,397
Number of piles.....		429

Bridge track and viaduct post foundations:

Length of piling used.....	feet..	82,105
Number of piles.....		2,020

Concrete placed—Bridge track and viaduct post foundations.

Month.	Concrete.	Rock.	Gravel.	Sand.	Cement.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Barrels.</i>
May.....	369	362	.....	167	498.5
June.....	2,613	1,024	1,500	771	3,326.2
Total.....	3,002	1,386	1,500	938	3,824.7

Air and water mains:		Linear feet laid.
April.....		1,700
May.....		1,200
June.....		1,200
Total.....		4,100
Tracks:		
April.....		4,690
May.....		5,280
June.....		3,997
Total.....		13,967
Dry fill (furnished by Panama R. R.):		Cubic yards.
February.....		16,340
March.....		16,380
April.....		5,875
May.....		851
June.....		9,155
Total.....		48,601
Excavation for foundations:		
April.....		110
May.....		1,346
June.....		2,570
Total.....		4,026

Caisson work.

Month.	Toes set.	Penetration.	Excavation.
		<i>Feet.</i>	<i>Cubic yards.</i>
May.....	59	472	
June.....	19	758	105
Total.....	78	1,230	105

The following is a list of the drawings accompanying this report:

- Plate 113. General plan of Balboa shops and yards.
- Plate 114. Dry Dock No. 1, Balboa, general plan.
- Plate 115. Dry Dock No. 1, Balboa, cross sections.
- Plate 116. Coaling plant, Balboa, general plan.
- Plate 117. Coaling plant, Balboa, cross sections.
- Plate 118. Balboa town site, general plan.
- Plate 119. Floating cranes *Ajax* and *Hercules*, elevations.
- Plate 120. Floating cranes *Ajax* and *Hercules*, plan and sections.
- Plate 121. Fuel-oil plant, Atlantic terminals, general plan.
- Plate 122. Fuel-oil plant, Pacific terminals, general plan.
- Plate 123. Coaling plant, Cristobal, general plan.
- Plate 124. Coaling plant, Cristobal, cross sections.
- Plate 125. East breakwater, general plan.
- Plate 126. East breakwater, cross sections.
- Plate 127. Type A tugs, deck plans.
- Plate 128. Type A tugs, outboard profile.

Respectfully submitted.

H. H. ROUSSEAU,
Civil Engineer, United States Navy,
Engineer of Terminal Construction.

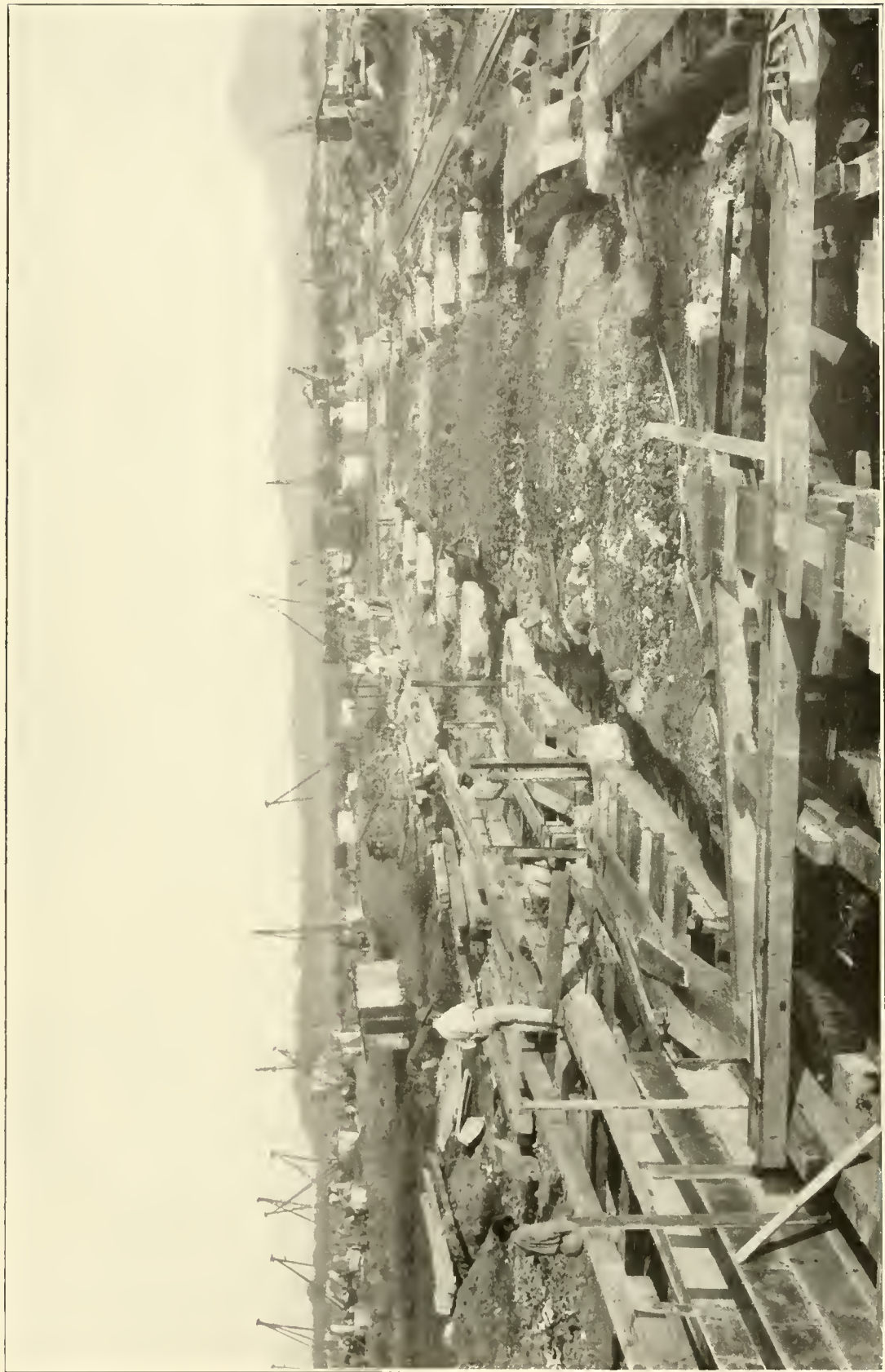
Col. GEO. W. GOETHALS, United States Army,
Governor, Panama Canal, Culebra, Canal Zone.



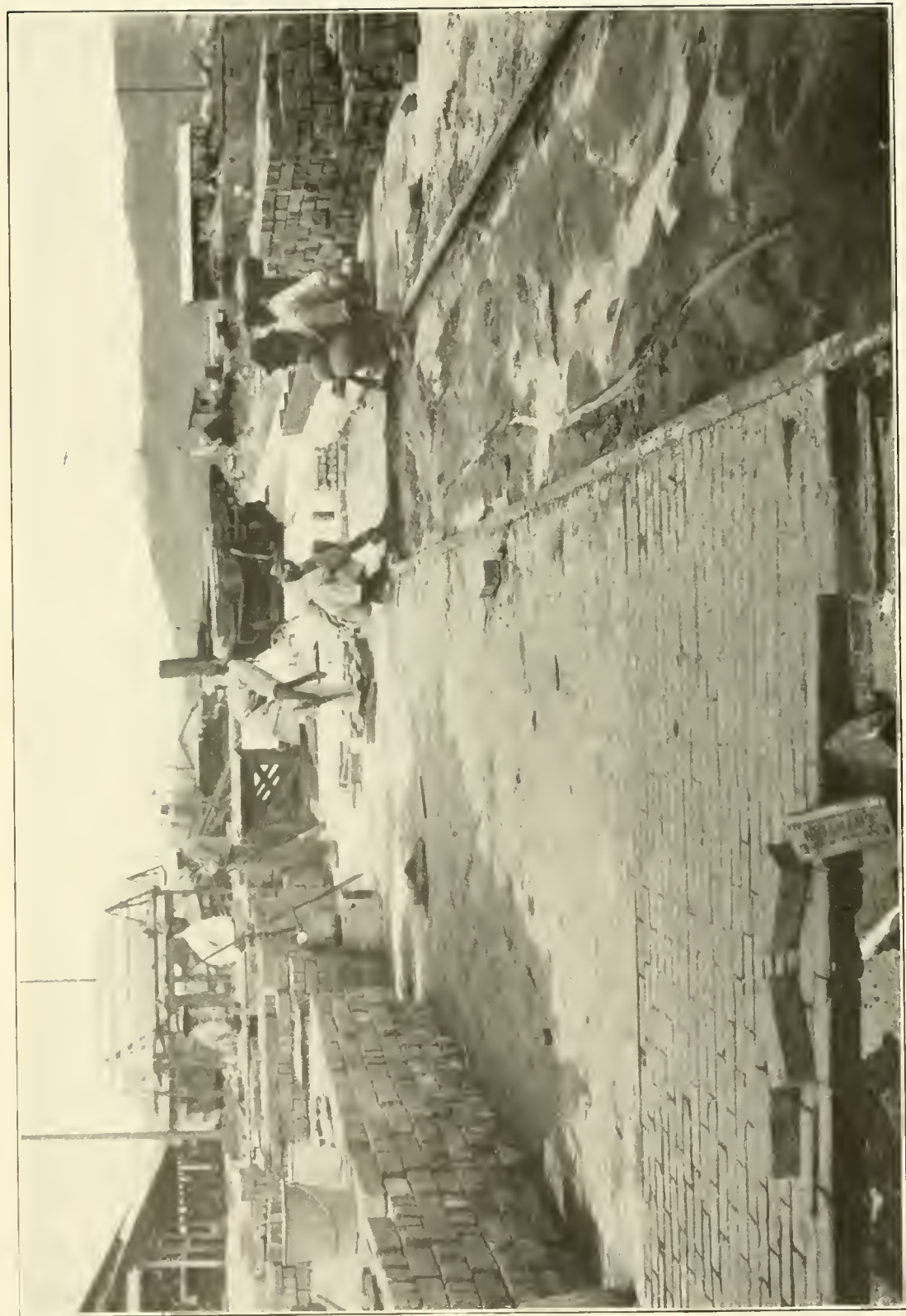
PACIFIC TERMINALS. BALBOA PLAIN AND BALBOA HEIGHTS, LOOKING NORTHEAST FROM TOP OF SOSA HILL. JULY 1, 1914.



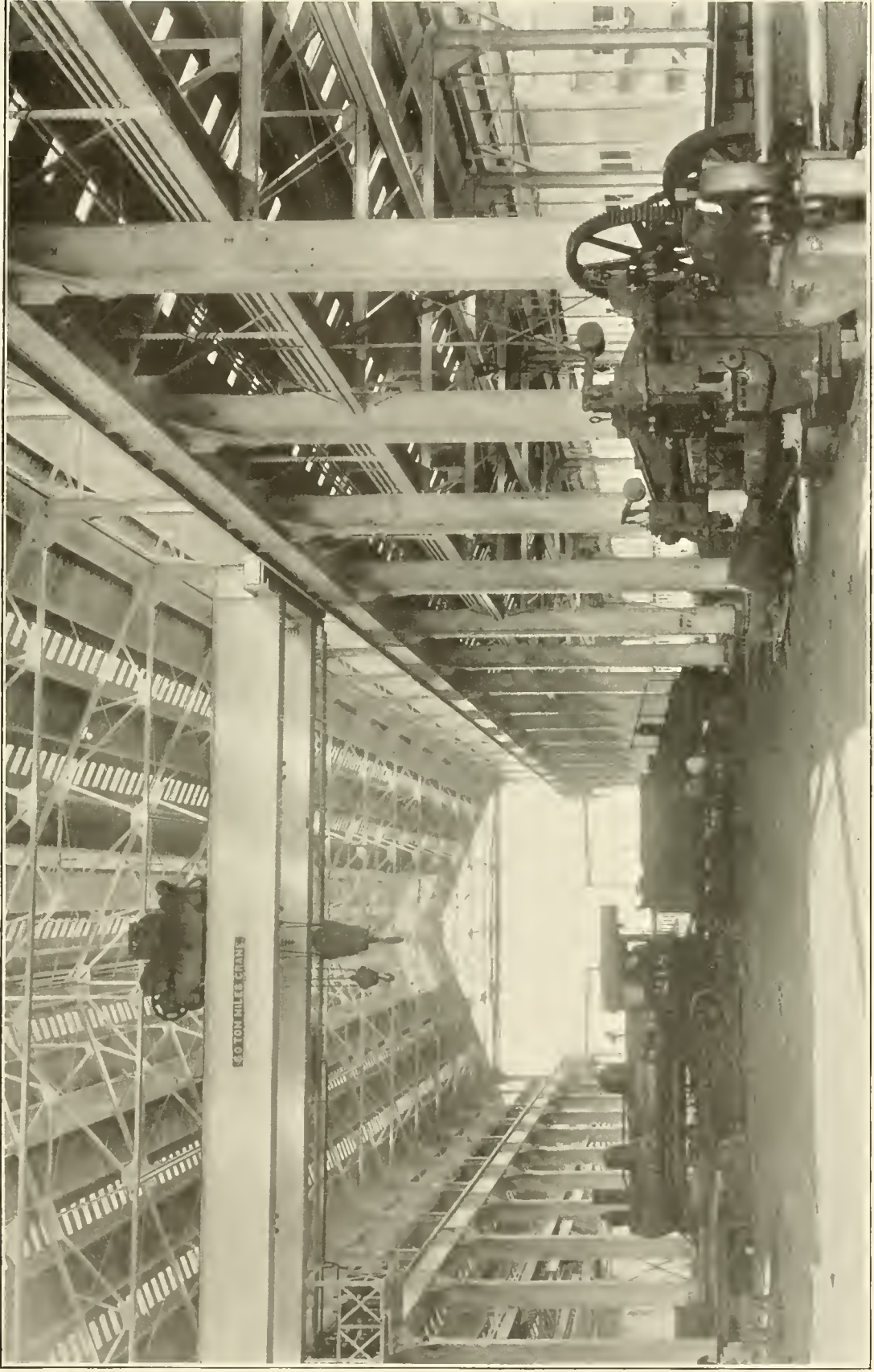
BALBOA TERMINALS. POURING CONCRETE IN QUAY WALL (G-H-I). NOVEMBER 26, 1913.



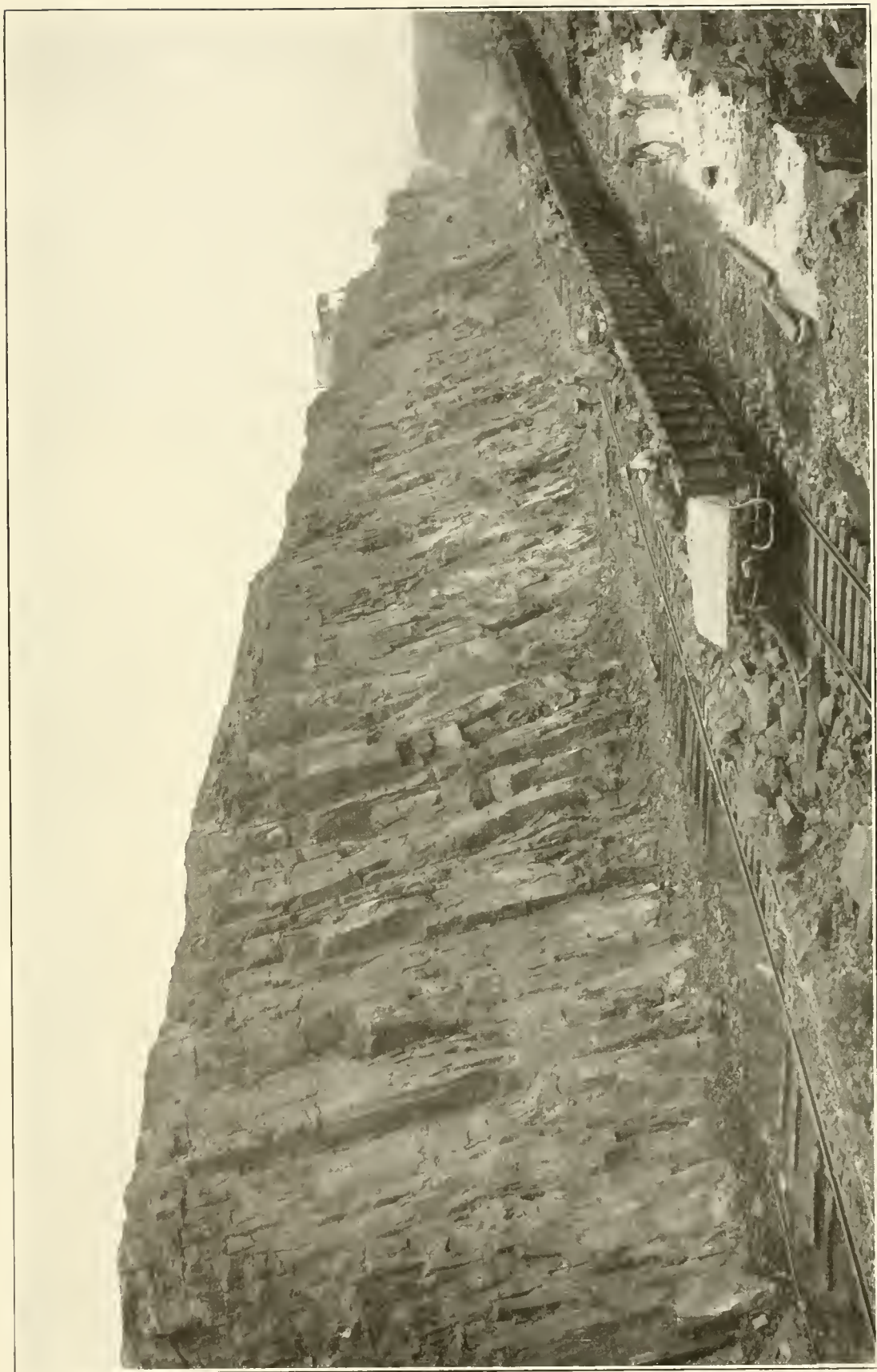
BALBOA TERMINALS. LOOKING FROM QUAY WALL (G-H-I) ALONG LINE OF BULKHEAD WALL OF NO. 1 SLIP, SHOWING CAISSONS SUNK TO ROCK AND FORMS BEING STARTED TO RECEIVE SUPERSTRUCTURE. JANUARY 27, 1914.



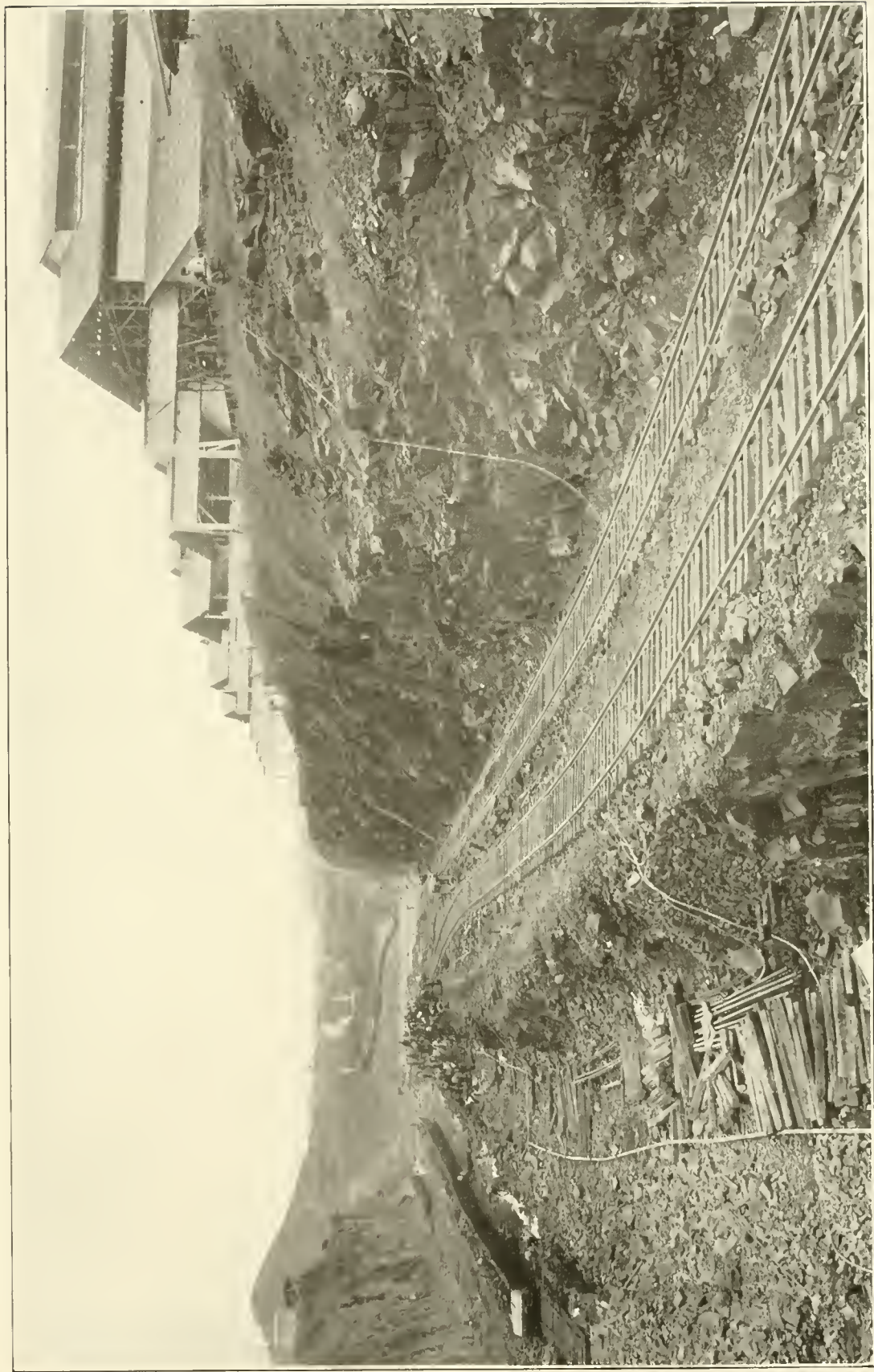
BALBOA TERMINALS. BRICK PAVING, EAST END OF QUAY WALL (G-H-I). MARCH 18, 1914.



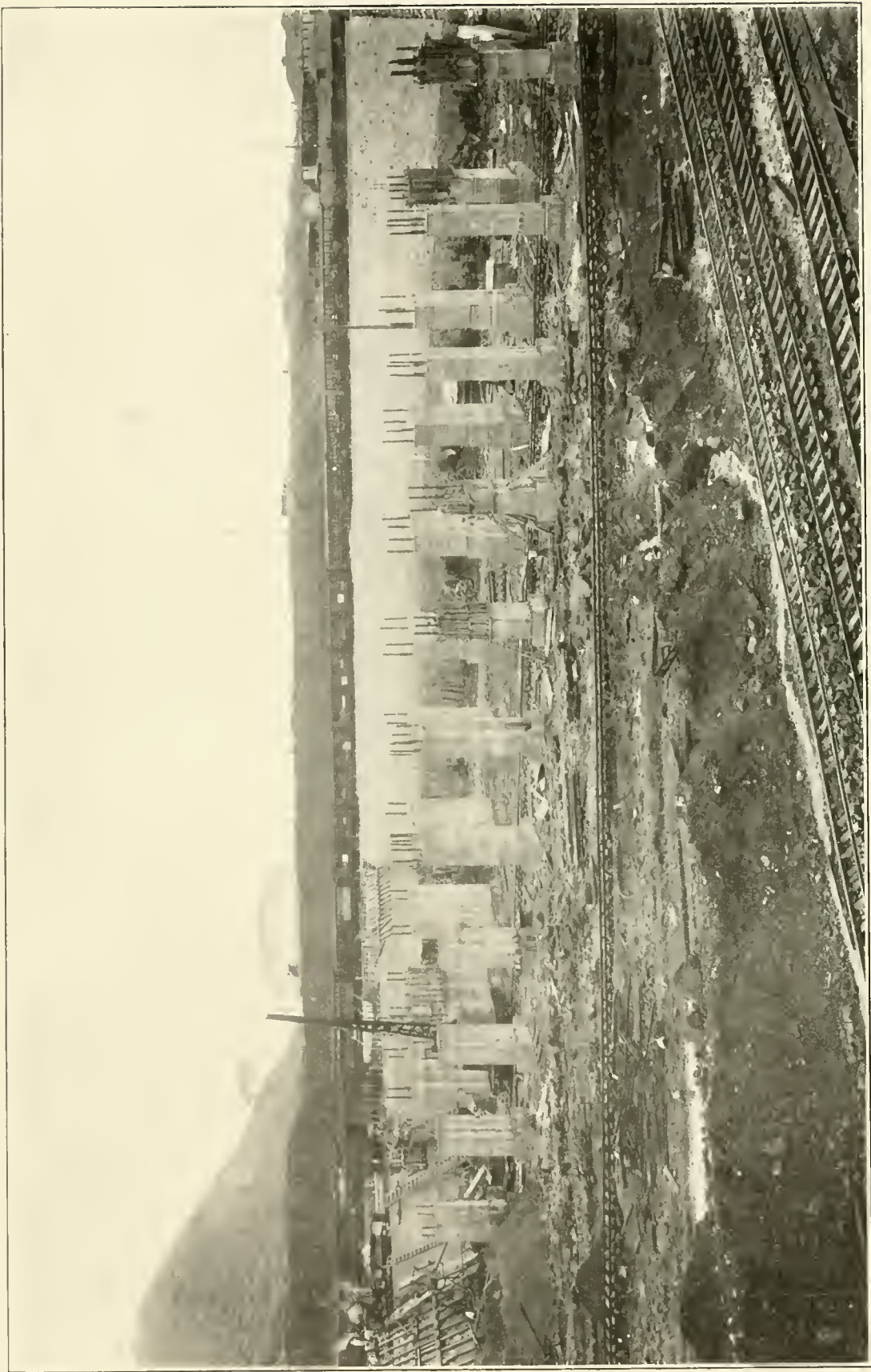
BALBOA TERMINALS. INTERIOR OF BOILER SHOP. JANUARY 27, 1914.



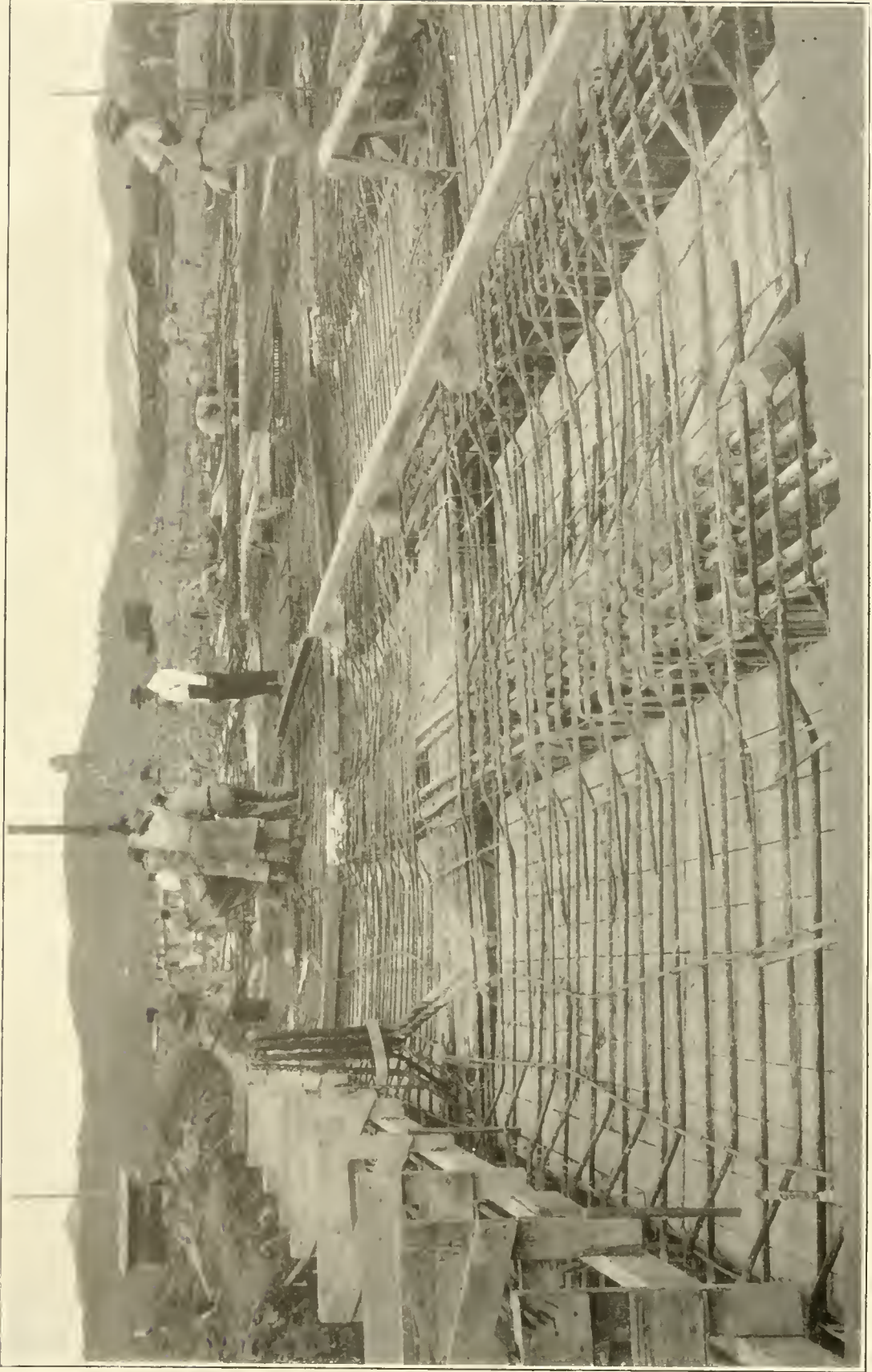
BALBOA TERMINALS. CONDITION OF SOUTH WALL OF DRY DOCK NO. 1 AFTER EXCAVATION BY STEAM SHOVELS TO ELEVATION -40. SLOPE TAKEN IS AT NATURAL DIP OF ROCK. JUNE 26, 1914.



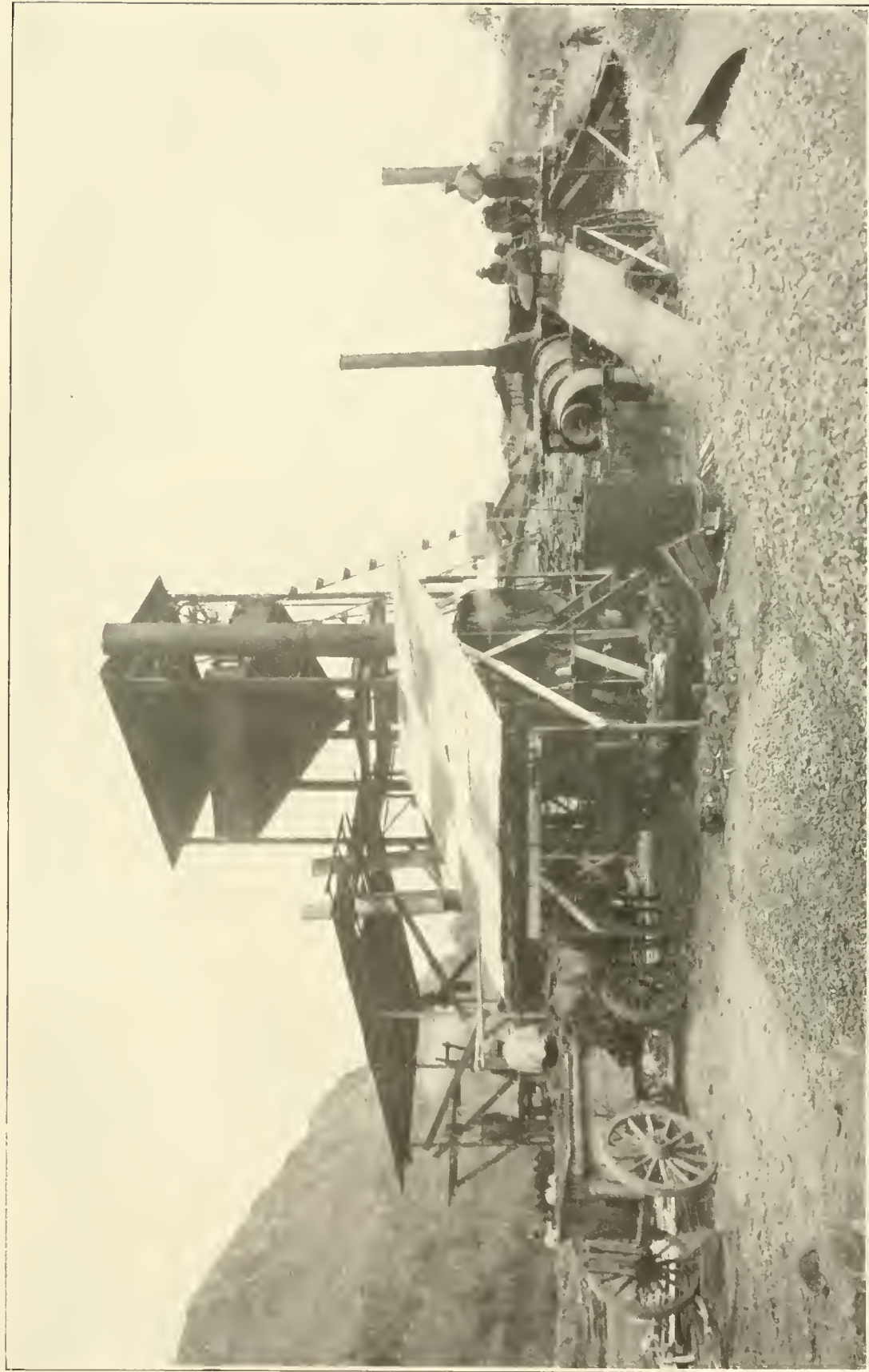
BALBOA TERMINALS. EAST END OF NORTH WALL OF DRY DOCK NO. 1, SHOWING CONDITIONS ALONG INCLINE.
JUNE 26, 1914.



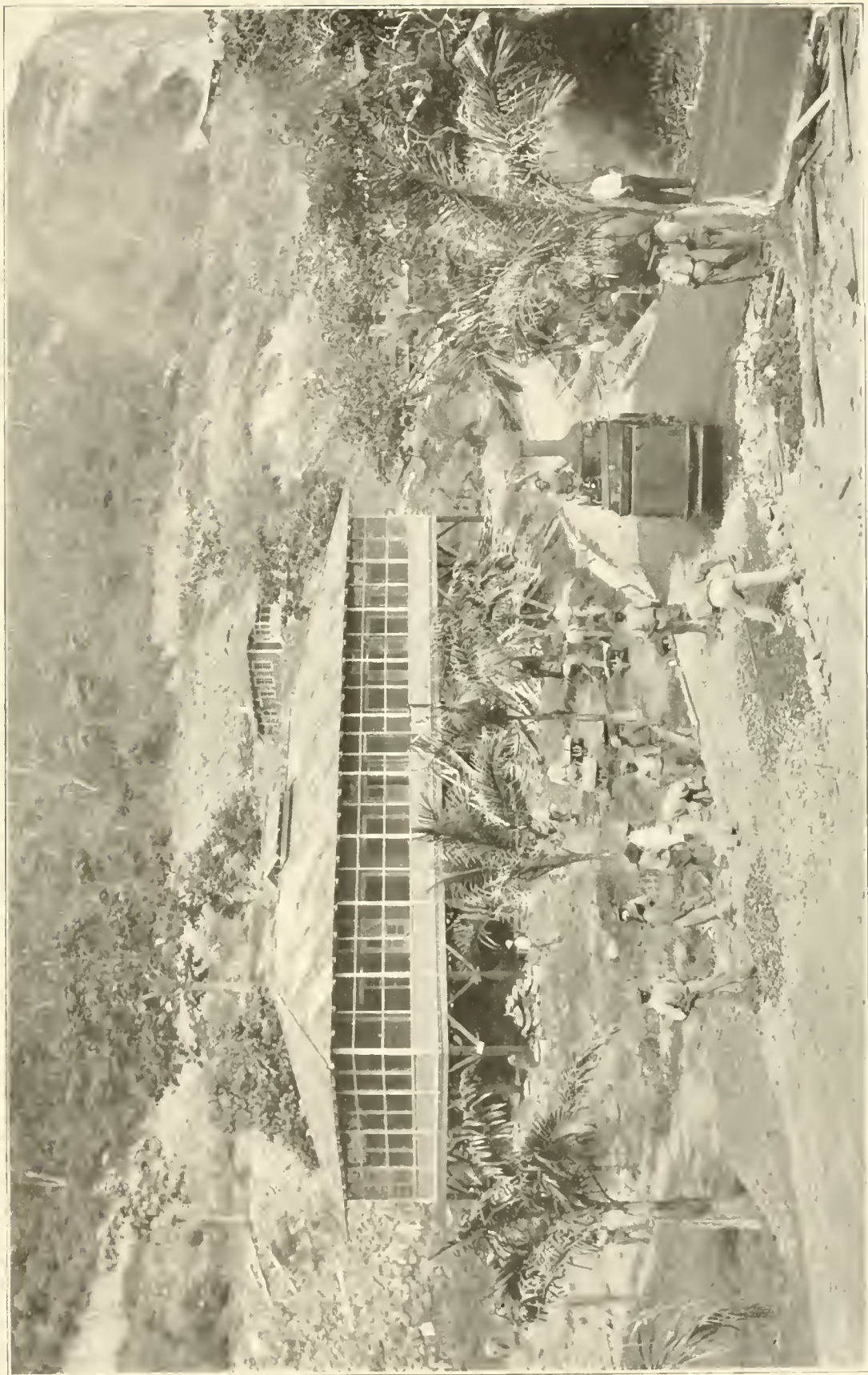
BALBOA TERMINALS. SUPPORTING RUNWAY PIERS FOR COAL REHANDLING CRANES OVER COAL POCKET. JUNE 30, 1914.



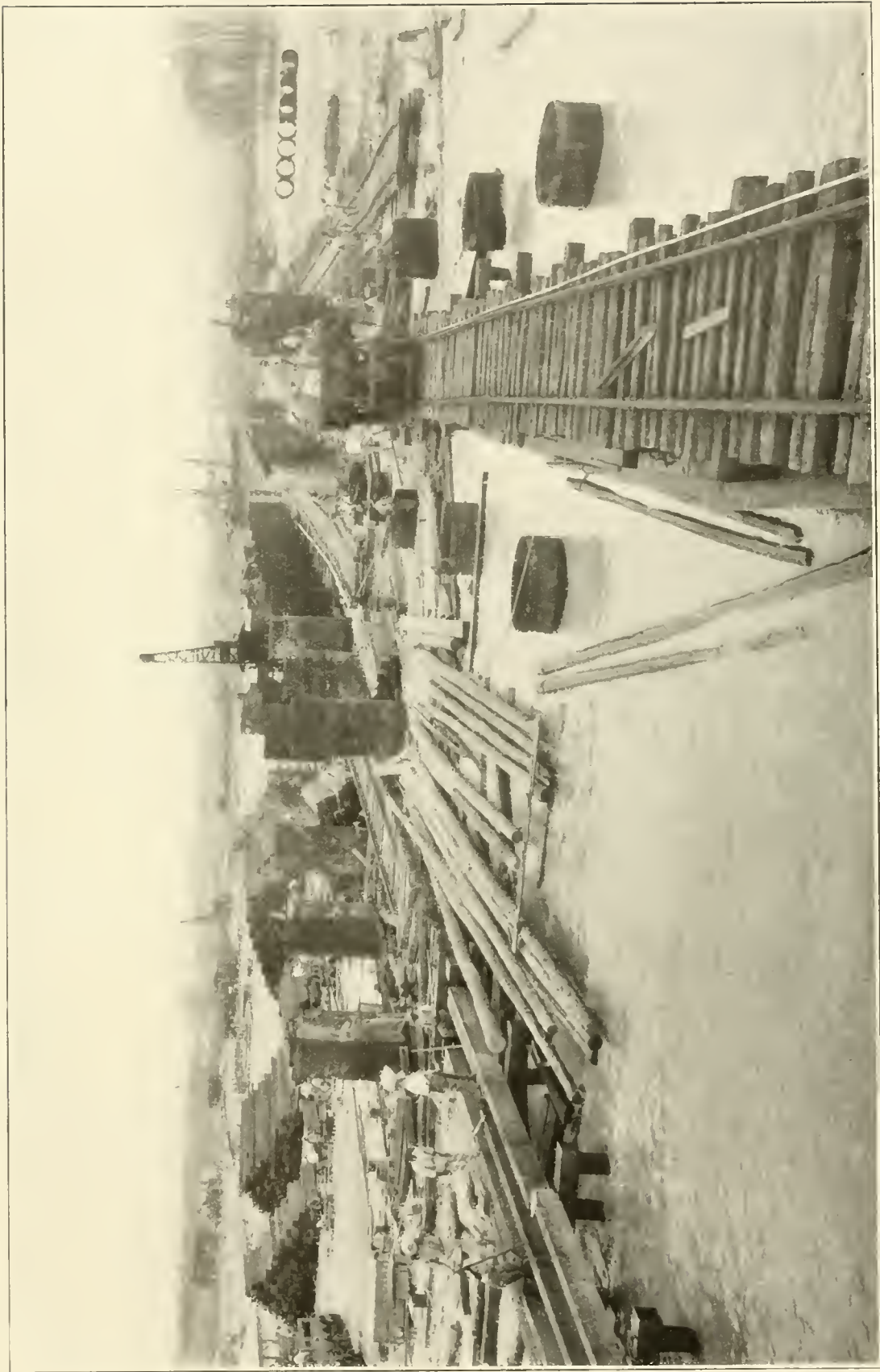
BALBOA TERMINALS. BEAM AND FLOOR REINFORCEMENT IN SUPERSTRUCTURE ON PIER NO. 1. JUNE 27, 1914.



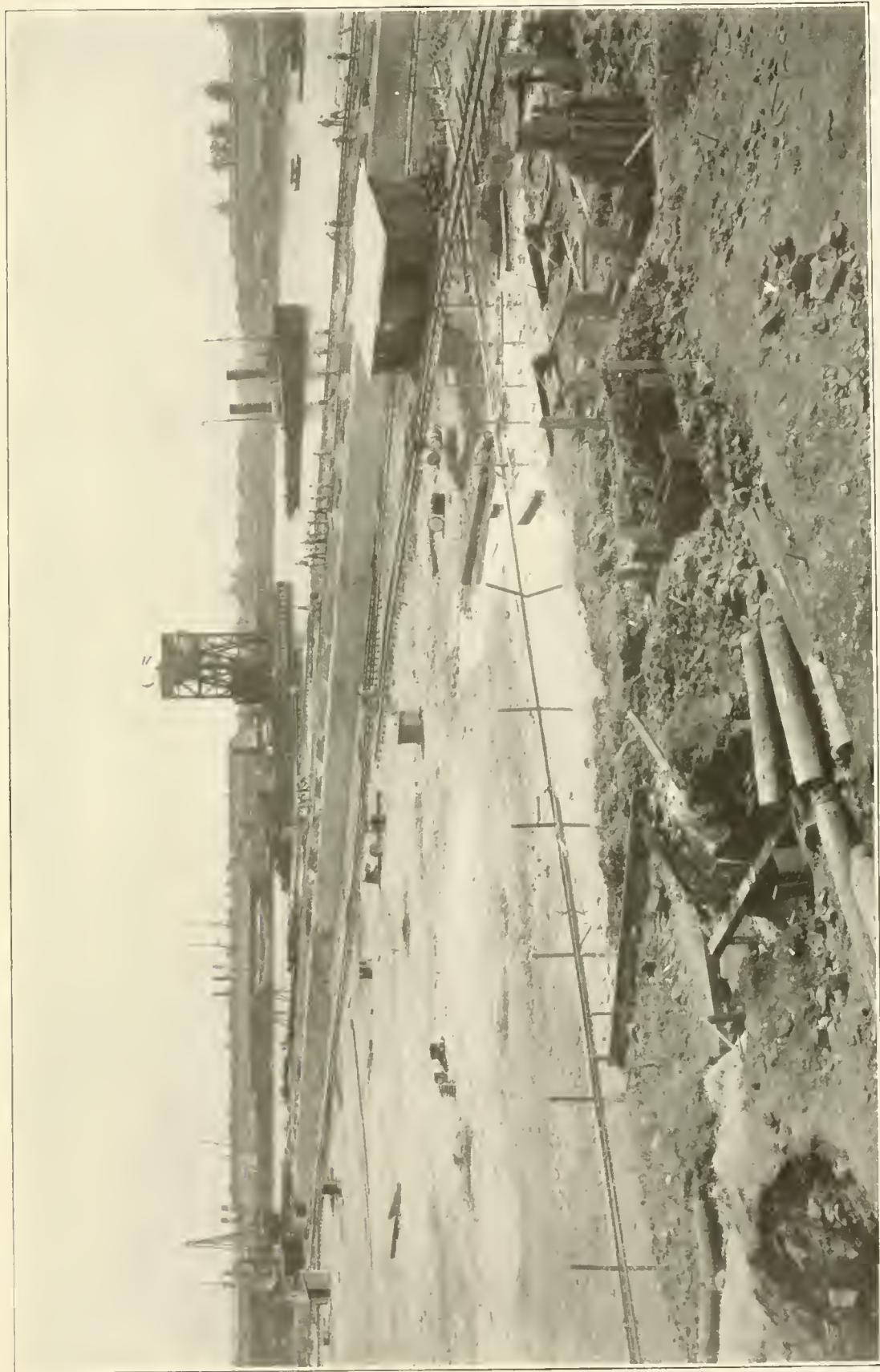
ASPHALT CONCRETE MIXING PLANT AT BALBOA. JUNE 27, 1914.



MAKING ASPHALT CONCRETE, E. ROADS AT BALBOA. JUNE 27, 1914.



CRISTOBAL COALING STATION, SHOWING CAISSONS IN RELOADER FOUNDATION. LOOKING SOUTH. MAY 26, 1914.



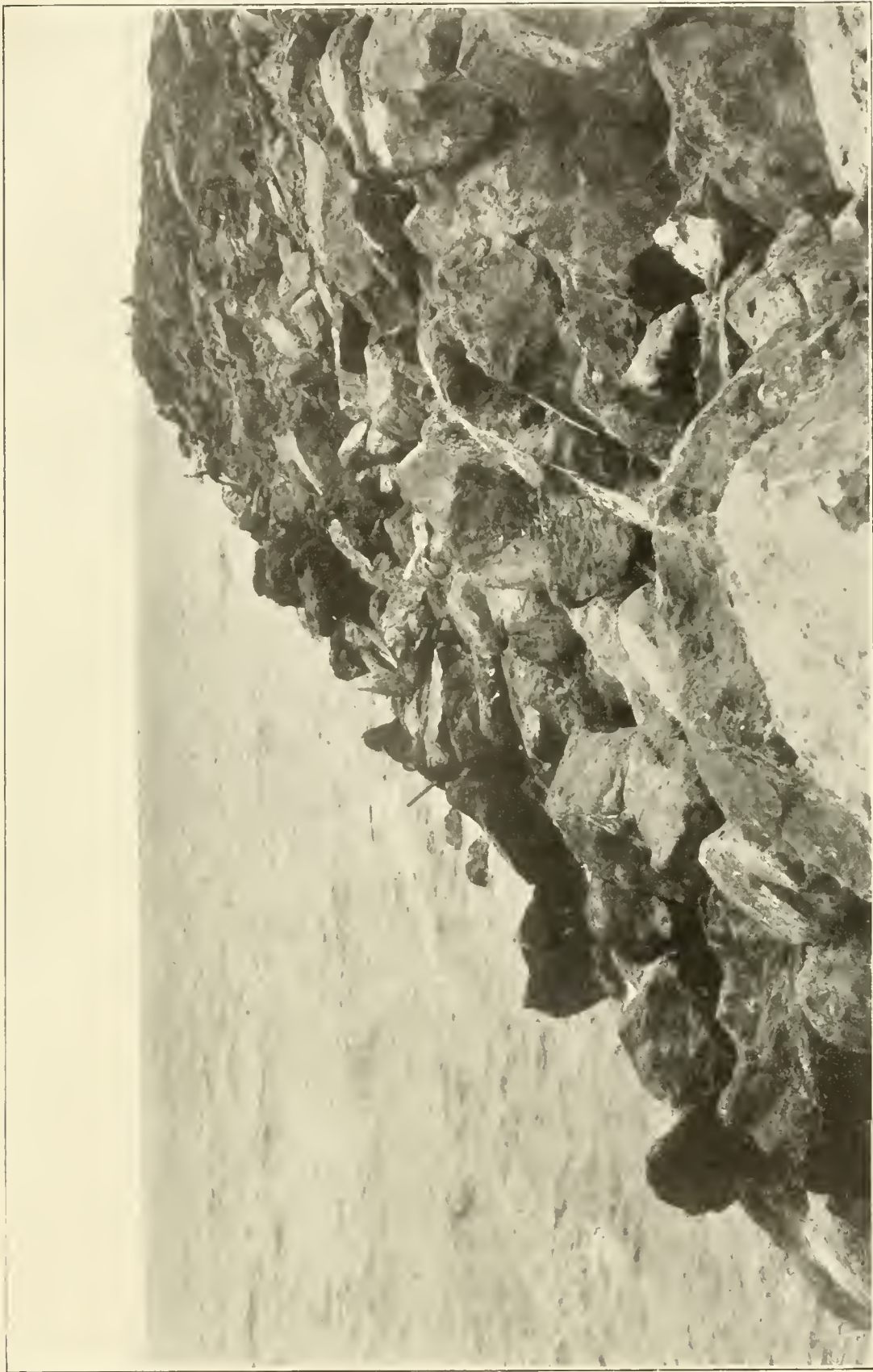
CRISTOBAL COALING STATION, SHOWING EAST BRIDGE TRACT WALL AND SOUTH END OF CAISSONS UNDER UNLOADING WHARF, LOOKING NORTH. JULY 9, 1914.



EAST BREAKWATER, LIMON BAY. COCO SOLO STORAGE YARD, LOOKING WEST FROM EAST END. AUGUST 12, 1914.



TORO POINT BREAKWATER, TOP VIEW, LOOKING OUT. APRIL 21, 1914.



TORO POINT BREAKWATER, SEA SLOPE, LOOKING OUT. APRIL 21, 1914.

APPENDIX C.

REPORT OF THE RESIDENT ENGINEER DREDGING DIVISION, DEPARTMENT OF OPERATION AND MAINTENANCE.

PARAISO, CANAL ZONE, *July 28, 1914.*

SIR: I have the honor to submit the following report of operations in the dredging division during the fiscal year ended June 30, 1914:

DIVISION ORGANIZATION.

The division is divided into two districts, the first district embracing all dredging operations in the Pacific entrance, Miraflores Lake, and Culebra Cut; the second district, all dredging operations in the Atlantic entrance and Gatun Lake to the Gamboa Bridge.

DREDGING.

The following dredges were at work during the year:

The seagoing suction dredge *Caribbean* was engaged throughout the year at the Atlantic entrance deepening the channel from deep water to station 290, removing the old dump in Limon Bay, maintaining the required depth in the Cristobal approach channel, and in excavating at the site of the new Pier No. 7, Cristobal.

The seagoing suction dredge *Culebra* was engaged in deepening the channel at the Pacific entrance, between station 2145 and deep water in Panama Bay, from July 1, 1913, to January 20, 1914; removing fill from the channel in Gatun Lake, mile 29-31, January 21 to February 22, 1914; removing shoal in Limon Bay, February 23 to June 13, 1914; excavating for oil basin and along the Panama Railroad steel wharf at Balboa, June 14 to 30, 1914.

The seagoing ladder dredge *Corozal* was engaged from July 1 to November 30, 1913, in excavating rock and stiff clay from the canal channel, between stations 2114 and 2146, Pacific entrance; December 1, 1913, to June 30, 1914, excavating at Cucaracha and Culebra slides in Culebra Cut.

The French ladder dredge *Badger* was employed, July 1 to December 14, 1913, in deepening the channel between stations 2115 and 2198, Pacific entrance; December 15, 1913, to March 18, 1914, in excavating at Cucaracha, Culebra, and Empire slides in Culebra Cut; and from March 19 to June 30, 1914, in deepening the channel between stations 2115 and 2135 of the canal, Balboa inner harbor, and sand dock.

The French ladder dredge *Gopher* was operated in the Chame sand pit from July 1, 1913, to February 7, 1914; in the canal channel between stations 2111 and 2115, February 8 to April 21, 1914; and at Chame sand pit from April 22 to June 30, 1914.

The French ladder dredge *Marmot* was engaged in deepening the channel between stations 2111 and 2142, July 1 to November 7, 1913; excavating at Cucaracha, Culebra, and Empire slides, November 8, 1913, to June 30, 1914.

The French ladder dredge *Mole* was operated in the channel between stations 2115 and 2130, Pacific entrance, July 1 to September 10, 1913, on which date she was permanently retired from service.

The French ladder dredge *No. 1* was engaged in deepening the channel between stations 261 and 356, Atlantic entrance, and maintaining depths at Docks Nos. 2 and 3, Colon, and Docks Nos. 13 and 14, Cristobal, from July 1 to October 20, 1913; October 21, 1913, to June 30, 1914, in excavating in Culebra Cut and digging gravel from the Chagres River above Gamboa.

The French ladder dredge *No. 5* was engaged in deepening the channel between stations 284 and 326, Atlantic entrance, July 1 to October 9, 1913; October 10, 1913, to April 21, 1914, excavating Gamboa Dike, Empire and Culebra slides in Culebra Cut; April 22 to June 30, 1914, in deepening the channel between stations 2115 and 2146 of the Pacific entrance, and maintaining the channel in the inner harbor.

The 5-yard dipper dredge *Cardenas* was engaged from July 1 to December 14, 1913, in deepening the channel between stations 2135 and 2250, Pacific entrance, and maintaining the channel along the sand dock and the Panama Railroad lumber wharf at Balboa; December 15, 1913, to June 30, 1914, excavating at Cucaracha and Culebra slides in Culebra Cut.

The 5-yard dipper dredge *Chagres* was engaged, July 1 to October 22, 1913, in deepening the channel between stations 220 and 360, Atlantic entrance; October 23, 1913, to June 30, 1914, excavating at Cucaracha and Culebra slides in Culebra Cut.

The 5-yard dipper dredge *Mindi* was engaged, July 1 to October 22, 1913, in deepening the channel between stations 223 and 291, Atlantic entrance; October 23, 1913, to June 30, 1914, excavating at Cucaracha and Culebra slides in Culebra Cut.

The 15-yard dipper dredge *Gamboa* went into commission on April 4, 1914, and operated at Culebra and Cucaracha slides, removing 7,459 cubic yards of earth and 256,730 cubic yards of rock from the canal prism.

The 15-yard dipper dredge *Paraiso* went into commission on June 7, 1914, and operated at Cucaracha slide, removing 69,812 cubic yards of rock from the canal prism.

The 18-inch pipe-line suction dredge *No. 4* was engaged in deepening the channel between stations 339 and 360, Atlantic entrance, and filling around the fortifications at Margarita Island, July 1 to December 11, 1913; December 12, 1913, to February 27, 1914, operating at Cucaracha slide in Culebra Cut; under repairs, February 28 to March 26, 1914; and filling around fortifications at Toro Point, March 27 to June 30, 1914.

The 20-inch pipe-line suction dredge *No. 82* was placed in commission on Gatun Lake, September, 1913, and was engaged in maintaining the channel, mile 30-31, to January 8, 1914; January 9, 1914, moved to Culebra Cut and used in connection with the hydraulic work at Cucaracha slide; May 2, 1914, moved to Miraflores Lake and was engaged in deepening the channel through the lake, to the end of the year.

The 20-inch pipe-line suction dredge *No. 83* was engaged in deepening the channel between stations 342 and 358, Atlantic entrance, making fills for the depot quartermaster at Mount Hope, pontoon bridge, and excavating at the Cristobal coaling station.

The 20-inch pipe-line suction dredge *No. 84 (Sandpiper)* was engaged in deepening the channel between stations 238 and 347, Atlantic entrance; maintaining the channel to the dry dock; excavating a basin at Coco Solo Point for the east breakwater, and filling the fortification reserve at Margarita Point.

The 20-inch pipe-line suction dredge *No. 85* was operated in Balboa inner harbor, July 1 to October 23, 1913; Cucaracha slide, October 24 to November 8, 1913; Miraflores Lake, November 9 to December 19, 1913; Balboa inner harbor, December 20, 1913, to June 30, 1914.

The 20-inch pipe-line suction dredge *No. 86* was engaged in deepening the channel between stations 316 and Gatun Locks, and in filling the fortification reserve at Margarita Point, July 1 to October 8, 1913; October 9 to 19, 1913, in maintaining channel, mile 30-31, Gatun Lake; October 20, 1913, to June 30, 1914, excavating at Cucaracha slide in Culebra Cut.

The following tables show the monthly output of all dredges, exclusive of the sand and gravel plants:

TABLE NO. 1.—Yardage removed, first district, Pedro Miguel Locks to sea.

Month and year.	Canal prism.			Auxiliary.			Grand total.
	Earth.	Rock.	Total.	Earth.	Rock.	Total.	
1913.							
July.....	446,878	310,052	756,930	231,105	.....	231,105	988,035
August.....	465,457	260,799	726,256	286,127	.....	286,127	1,012,383
September.....	321,246	260,712	581,958	178,579	.....	178,579	760,537
October.....	264,556	168,542	433,098	110,660	.....	110,660	543,758
November.....	225,983	115,602	341,585	6,912	2,688	9,600	351,185
December.....	172,613	9,664	182,277	93,066	.....	93,066	275,343
1914.							
January.....	86,585	.....	86,585	205,656	.....	205,656	292,241
February.....	.....	9,275	9,275	135,150	.....	135,150	144,425
March.....	2,796	10,924	13,720	166,092	.....	166,092	179,812
April.....	2,923	8,286	11,209	254,973	5,393	260,366	271,575
May.....	56,113	22,269	78,382	143,543	.....	143,543	221,925
June.....	97,490	10,307	107,797	213,229	2,571	215,800	323,597
Total.....	2,142,640	1,186,432	3,329,072	2,025,092	10,652	2,035,744	5,364,816

TABLE NO. 2.—Yardage removed, first district (Culebra Cut), Pedro Miguel Locks to Gamboa Dike.

Month and year.	Canal prism.			Auxiliary.			Grand total.
	Earth.	Rock.	Total.	Earth.	Rock.	Total.	
1913.							
July.....							
August.....							
September.....							
October.....	15,943	44,427	60,370				60,370
November.....	47,592	151,602	199,194				199,194
December.....	131,695	302,507	434,202				434,202
1914.							
January.....	119,456	325,766	445,222				445,222
February.....	97,781	335,005	432,786				432,786
March.....	115,718	261,091	376,809				376,809
April.....	183,008	296,638	479,646				479,646
May.....	114,830	359,301	474,131				474,131
June.....	93,632	436,371	530,003				530,003
Total.....	919,655	2,512,708	3,432,363				3,432,363

TABLE No. 3.—Yardage removed, second district.

Month and year.	Canal prism.			Auxiliary.			Grand total.
	Earth.	Rock.	Total.	Earth.	Rock.	Total.	
1913.							
July.....	852,607	69,341	921,948	153,020	16,015	169,035	1,090,983
August.....	487,600	24,489	512,089	190,141	24,414	214,555	726,644
September.....	450,517	28,172	478,689	148,150	26,519	174,669	653,358
October.....	393,302	28,161	421,463	93,837	37,853	131,690	553,153
November.....	316,588	8,831	325,419	30,593	42,055	72,648	398,067
December.....	345,701	.....	345,701	123,682	25,128	148,810	494,511
1914.							
January.....	173,767	.....	173,767	162,807	26,867	189,674	363,441
February.....	378,634	.....	378,634	105,665	56,876	162,541	541,175
March.....	112,466	.....	112,466	264,407	32,219	296,626	409,092
April.....	.....	.....	.....	469,951	2,264	472,215	472,215
May.....	.....	.....	.....	477,492	2,544	480,036	480,036
June.....	22,400	.....	22,400	321,011	18,106	339,117	361,517
Total.....	3,533,582	158,994	3,692,576	2,540,756	310,860	2,851,616	6,544,192

On July 1, 1914, there remained to be removed from the canal prism, including siltage, 3,217,105 cubic yards of earth and 4,891,958 cubic yards of rock.

The following table shows dredges retired for repairs and renewals:

	Name.	Type.	Time out of service.
			Days.
1	Culebra.....	Seagoing suction dredge.....	9
2	Caribbean.....	do.....	42
3	Gamboa.....	15-yard dipper dredge.....	16
4	Paraiso.....	do.....	.....
5	Cardenas.....	5-yard dipper dredge.....	49
6	Chagres.....	do.....	52
7	Mindi.....	do.....	10
8	Marmot.....	French ladder dredge.....	40
9	Gopher.....	French ladder dredge (marine).....	13
10	Badger.....	French ladder dredge.....	16
11	Mole.....	French ladder dredge (marine).....	.....
12	No. 1.....	French ladder dredge.....	24
13	No. 5.....	do.....	38
14	Corozal.....	Seagoing ladder dredge.....	68
15	No. 85.....	Pipe-line suction dredge.....	21
16	No. 84.....	do.....	72
17	No. 4.....	do.....	70
18	No. 82.....	do.....	3
19	No. 83.....	do.....	66
20	No. 86.....	do.....	32

SUBAQUEOUS ROCK EXCAVATION.

FIRST DISTRICT, PEDRO MIGUEL LOCKS TO SEA.

Of hard and soft rock 1,186,432 cubic yards were removed from the canal prism during the year; of this amount 146,477 cubic yards were drilled and blasted by the drill barge *Teredo*, and 60,832 cubic yards were broken by the rock breaker *Vulcan*. The remainder includes rock which had been drilled and blasted by well drills in previous years and material which could be handled by the dredges without mining. On this work 539,273 pounds of dynamite were used during the year.

FIRST DISTRICT, CULEBRA OUT.

From the canal prism 2,512,708 cubic yards of rock were removed during the year; of this amount 62,370 cubic yards were drilled and blasted by the *Teredo* and well drills. The remainder includes rock blasted in the dry and material which could be handled without mining. On this work 89,610 pounds of powder were used during the year.

The following table shows locations of rock shoals worked, and monthly statement of volume removed:

Month and year.	Station and method of breaking.		Area covered.	Amount dredged.
	Teredo.	Vulcan.		
1913.			<i>Square feet.</i>	<i>Cubic yards.</i>
July.....	2248, 2249, 2250, 2251, 2252.....	2185-E.....	80, 176	310, 052
August.....	2248, 2249, 2250, 2251.....	2185, 2190, 2191, 2192, 2193, 2194..	70, 783	260, 799
September.....	2172, 2177, 2178, 2179, 2249, 2250..	2145, 2150, 2160, 2192, 2193, 2194, 2195, 2196.	56, 664	260, 712
October.....	2143, 2144, 2145, 2146, 2147, 2148..	2125, 2145, 2173, 2178, 2155-E....	96, 283	212, 969
November.....	2112, 2113, 2114, 2138, 2139, 2140, 2141, 2142, 2143.	2135, 2136, 2155.....	110, 331	267, 204
December.....	2111, 2112, 2113, 2114, 2115, 2116..	2135-W, 2155-E.....	126, 698	312, 171
1914.				
January.....	2113, 2114, 2115, 2116, 2118, 2119..	2155-E, 2115-W.....	72, 822	325, 766
February.....	2115, 2116, 2117.....	2115, 2140, 2145-W.....	73, 789	344, 280
March.....	2113, 2114, 2115.....	2140, 2160, 2170, 2175-W.....	82, 251	272, 015
April.....	2114, 2115, 2116.....	2164, 2175, 2182-W.....	66, 226	304, 924
May.....	2105, 2115, 2116, 2117, 2125, 2126..	2182, 2195, 2200, 2205-W.....	84, 434	381, 570
June.....	2124, 2125, 2126; Cucaracha slide (1810, 1813).	2205, 2210-W.....	89, 361	446, 678
Total.....			1, 009, 868	3, 699, 140

SECOND DISTRICT.

From the canal prism 158,994 cubic yards of rock were removed during the year; all of this material had been drilled and blasted in previous year by the *Terrier* and well drills. Five hundred pounds of powder were used in dobying.

Of coral rock 74,813 linear feet were drilled, and 491,412 cubic yards blasted by the drill boat *Terrier* and seven well drills at the Cristobal coaling station. On this work 378,282 pounds of dynamite were used.

All mining operations in the second district during the year were at Cristobal coaling station site.

DREDGING OPERATIONS.

ATLANTIC ENTRANCE.

Dredges were at work throughout the year deepening the canal and on auxiliary excavation. There were excavated 5,567,143 cubic yards of earth and 464,819 cubic yards of rock.

GATUN LAKE.

Dredges operating in Gatun Lake, mile 29-31, from October, 1913 to February, 1914, removed 507,195 cubic yards of earth and 5,035 cubic yards of rock from the canal prism.

CULEBRA CUT.

Active dredging operations in Culebra Cut began on October 23, 1913 and continued throughout the year. From the canal prism, 919,655 cubic yards of earth and 2,512,708 cubic yards of rock were removed; of this amount 865,015 cubic yards of earth and 1,557,360 cubic yards of rock were removed from Cucaracha slide. Six hundred and eighty-four thousand five hundred and fourteen cubic yards of earth and 77,880 cubic yards of rock were removed by pipe line dredges, and, with the assistance of a relay, were pumped over the west bank of the canal into the Rio Grande Valley.

Cucaracha slide has been very active since dredging operations were started, the daily movement averaging about $2\frac{1}{2}$ feet. On June 30, 1914, the total area of slide was 60.4 acres—44.6 acres active and 15.8 acres without motion.

MIRAFLORES LAKE.

Dredging was done during four months of the year. From the canal prism 159,817 cubic yards of earth were removed.

PACIFIC ENTRANCE.

Dredges were at work throughout the year deepening the canal channel, inner harbor, and around the docks; 4,007,915 cubic yards of earth and 1,197,084 cubic yards of rock were excavated.

ATLANTIC TERMINALS.

Dredges at work during the year removed 18,286 cubic yards of earth and 16,015 cubic yards of rock from the site of the bridge crossing the French canal south of the dry dock; 117,289 cubic yards of earth from the approach channel; 275,993 cubic yards of earth and 46,360 cubic yards of rock from the new Piers Nos. 7, 8, and 9; and 181,709 cubic yards of earth and 213,325 cubic yards of rock from the coaling station.

Seventeen thousand cubic yards of material excavated at the coaling station were placed in the fill for the substation, and 304,411 cubic yards were placed in fills for bridge foundations, coal basins, and yards at the coaling station.

PACIFIC TERMINALS.

Dredges at work during the year removed 1,919,003 cubic yards of earth and 7,964 cubic yards of rock; of this amount 1,831,711 cubic yards of earth were handled by pipe-line dredges and relay, and placed in fills for reclaiming swamp lands.

MISCELLANEOUS.

One hundred and ninety-three thousand seven hundred and eighty-two cubic yards of sand were dredged at Chame sand pit and delivered to various divisions, departments, and outside companies for construction purposes.

One hundred and thirteen thousand eight hundred cubic yards of gravel were dredged from the Chagres River gravel beds above Gamboa, and delivered to the various departments and divisions.

Auxiliary dredging in the first district includes 1,919,003 cubic yards of earth and 7,964 cubic yards of rock removed from the inner harbor; 45,313 cubic yards of earth from the Panama Railroad steel wharf, 2,688 cubic yards of earth from the sand dock, and 60,776 cubic yards of earth from the oil basin.

Auxiliary excavation at the Atlantic entrance includes 574,630 cubic yards of earth removed from the shoals in Limon Bay; 179,289 cubic yards of earth from the approach channel; 15,838 cubic yards of earth from the Cristobal Harbor; 11,026 cubic yards of earth from Docks Nos. 2 and 3, Colon; 275,993 cubic yards of earth and 46,360 cubic yards of rock from Piers Nos. 7, 8, and 9, Cristobal; 51,344 cubic yards of earth and 7,306 cubic yards of rock at Coco Solo; 997,388 cubic yards of earth and 27,854 cubic yards of rock for fortifications at Margarita Island; 290,804 cubic yards of earth for fortifications at Toro Point; 181,709 cubic yards of earth and 213,325 cubic yards of rock at the coaling station; 18,286 cubic yards of earth and 16,015 cubic yards of rock at the French Canal bridge crossing, 4,489 cubic yards fill at Mount Hope for the depot quartermaster, and 1,960 cubic yards of earth for the pontoon bridge construction.

One hundred and thirty-eight thousand and seventeen cubic yards of rock were dumped in the vicinity of the west breakwater during the year, making a total to date of 1,948,125 cubic yards; of this amount 669,254 cubic yards were dumped within the breakwater section proper.

The siltage in the canal prism for the year amounted to 640,410 cubic yards on the Atlantic, and 680,400 cubic yards on the Pacific end.

One hundred wash borings were taken at the Cristobal coaling station, and 54 at the oil basin, Balboa.

Three temporary wing dikes, 650, 450, and 250 feet long, were constructed in September on the south shore of Limon Bay to prevent further erosion of the beach. These dikes were partially destroyed by heavy seas in January and February, 1914.

The drill boat *Terrier* sank on the coral reef at the coaling station, Cristobal, on December 24, 1913. Wreck was raised and placed in obsolete fleet January 2, 1914.

The dredging division for the year 1913-14 has been operating mostly on a cleaning-up basis, and the output of the seagoing suction dredges has been low owing to the sparse material and long haul.

The 15-yard dipper dredge *Gamboa* was put in commission on April 4, and the *Paraiso*, a similar dredge, on June 7, 1914.

Six 1,000-yard dump scows were received and placed in commission on the following dates: Two on December 19, 1913; two on January 30, 1914; and two on March 25, 1914.

The above is the only new equipment put in commission for the dredging service.

A table of material excavated, covering the principal years of excavation, is quoted below:

Year.	Output in cubic yards.		
	Earth.	Rock.	Total.
1907-8.....	10,348,575	12,417	10,360,992
1908-9.....	14,224,676	451,894	14,679,570
1909-10.....	12,358,561	624,431	12,982,992
1910-11.....	12,558,215	811,889	13,370,104
1911-12.....	9,799,551	1,083,423	10,882,974
1912-13.....	12,008,018	2,049,552	14,057,570
1913-14.....	11,161,725	4,179,646	15,341,371

For the purpose of comparison, the output of the dredges *Gamboa* and *Paraiso* is deducted from the figure for 1913-14, leaving 11,154,126 cubic yards of earth, and 3,853,104 cubic yards of rock, a total of 15,007,370 cubic yards.

The year 1913-14, as compared with the year 1912-13, shows a decrease of 853,892 cubic yards of earth, and an increase in rock excavation of 1,803,552 cubic yards, or an increase in the yearly total of 949,800 cubic yards; as compared with the year 1908-09, which has the greatest total of any previous year, a decrease of 3,070,550 cubic yards of earth, an increase of 3,398,210 cubic yards of rock, or an increase in the yearly total of 327,800 cubic yards.

CLEARINGS AND DIVERSIONS.

A force of men was engaged in clearing brush and trees and blasting stumps from the dredging area of the inner harbor from July, 1913, to April, 1914; 509,650 square feet were cleared during the year; 3,702 pounds of dynamite were used on this work.

Two hundred and fourteen linear feet of diversion channels were excavated for drainage of lands reclaimed by hydraulic filling. This work was turned over to the second division in September, 1913.

PARAISO WHARF.

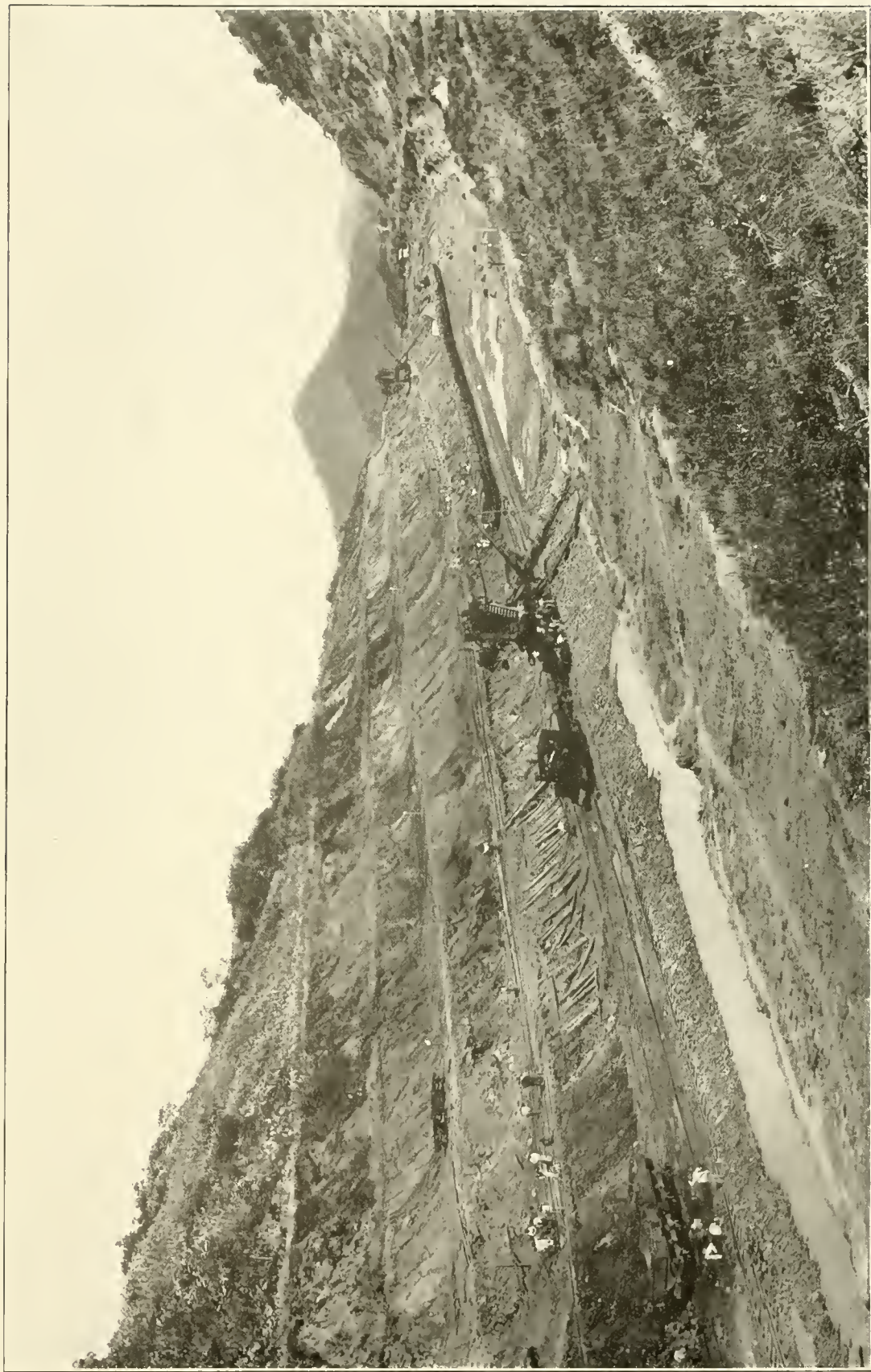
A wooden wharf, 500 feet long and 25 feet wide, was built at Paraiso for the use of the floating plant.

PONTOON BRIDGE.

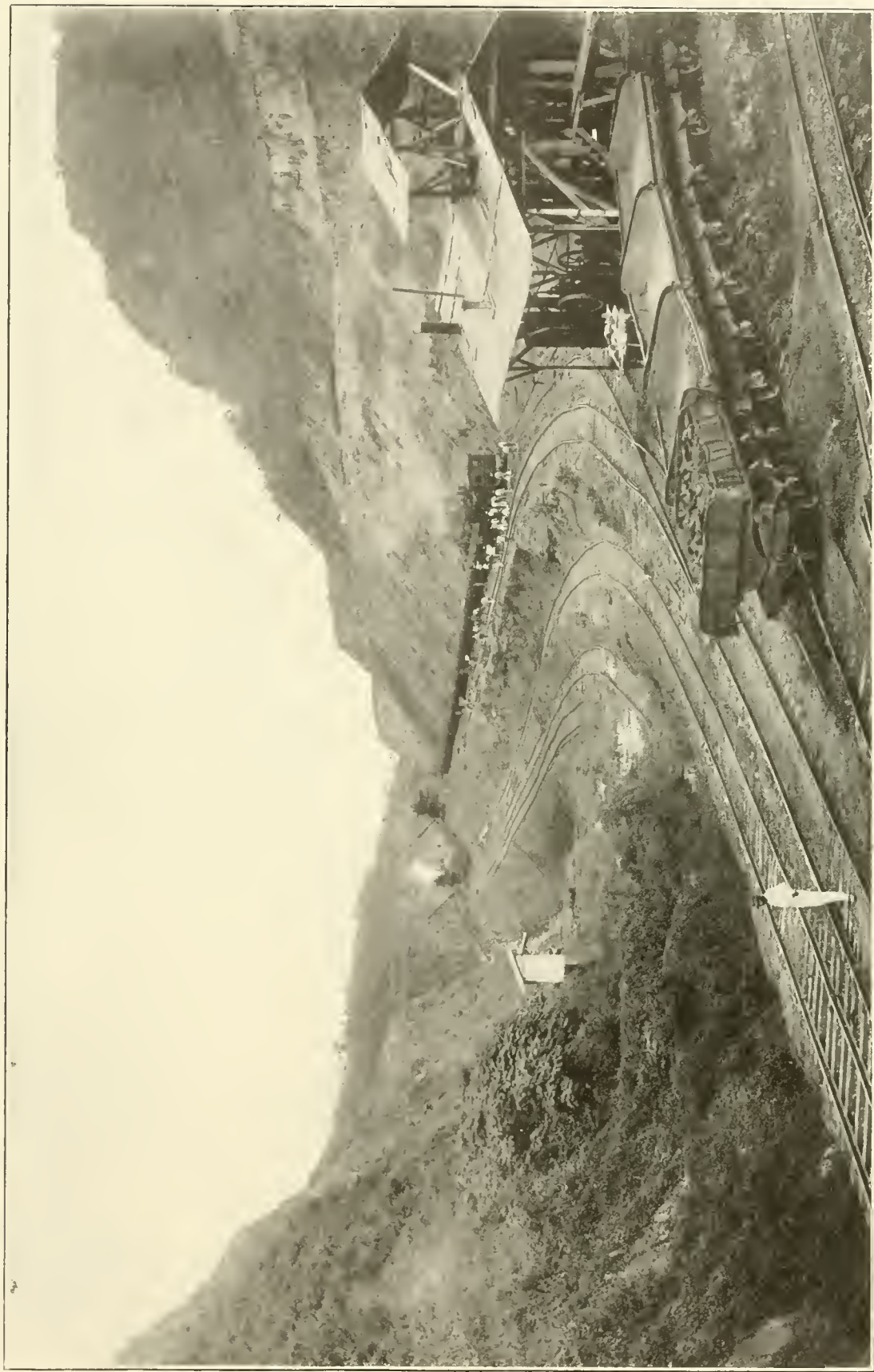
A pontoon bridge for railroad crossing of the canal was constructed under supervision of the dredging division, as directed in your letter of August 30, 1913. This bridge consists of a wooden hull 378 feet long, 55 feet wide, and 6 feet 3 inches deep, built of creosoted lumber throughout. A special force of men was employed for this work. Construction began on October 9, 1913, at the Cristobal Dry Dock; hull was launched March 25, 1914, and brought to Paraiso on March 27 for the erection of necessary trestlework and superstructure. All work completed, with exception of laying of rails, ties, etc., and bridge swung into position on May 5. Passage of trains commenced May 14, 1914.



CULEBRA CUT, LOOKING SOUTH FROM A POINT NEAR PRESENT 1726. JANUARY 25, 1905.



CULEBRA CUT, BETWEEN GOLD AND CONTRACTORS HILLS, IN 1890. LOOKING SOUTH.



CULEBRA CUT, BETWEEN GOLD AND CONTRACTORS HILLS, IN 1890. LOOKING NORTH.



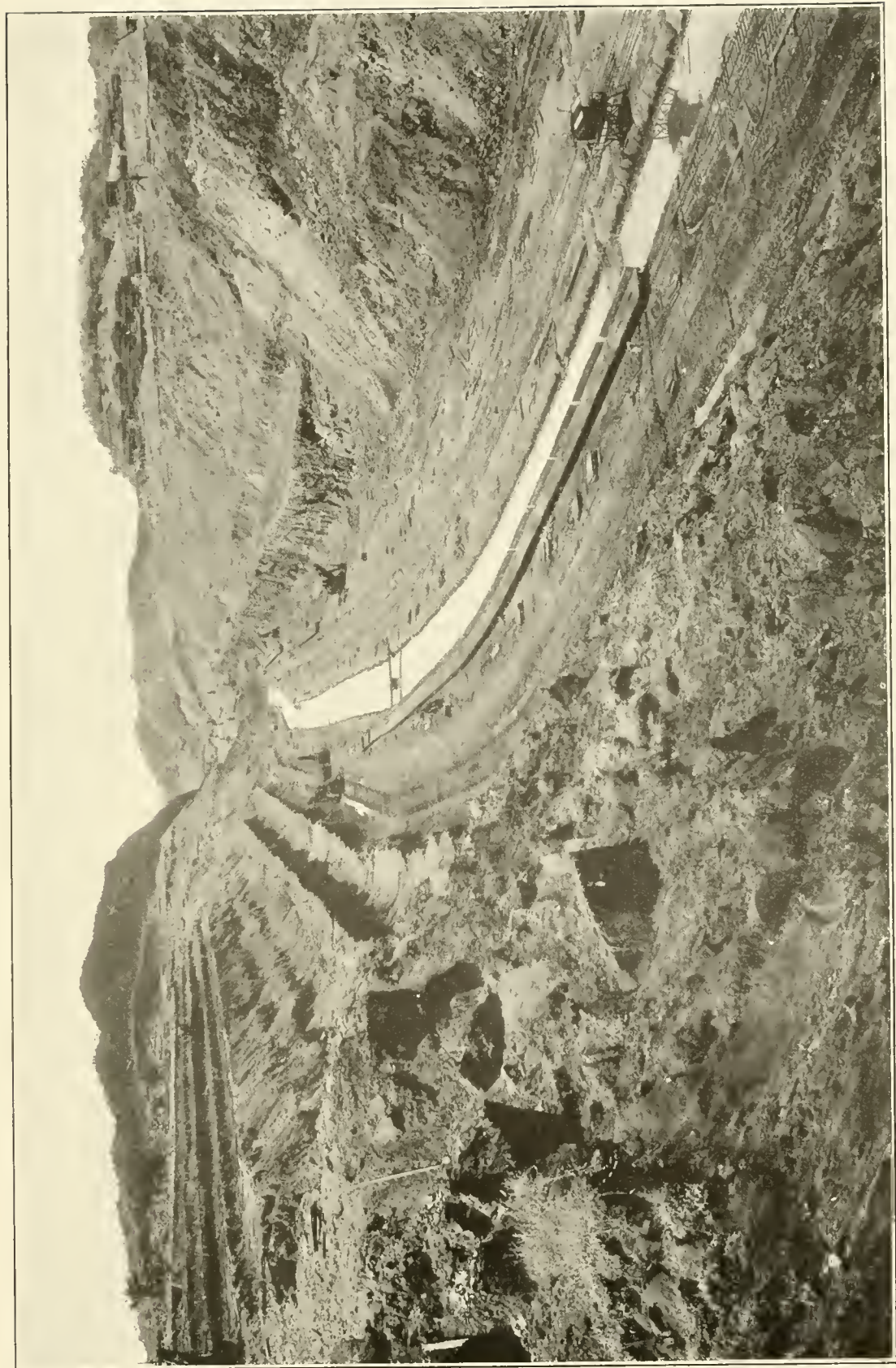
CULEBRA CUT, LOOKING NORTH FROM CONTRACTORS HILL, DECEMBER 28, 1907.



CULEBRA CUT, LOOKING SOUTH FROM CONTRACTORS HILL (EXCAVATION COMPLETED SOUTH OF CUCARACHA SLIDE).
JULY 19, 1913.



CULEBRA CUT, LOOKING SOUTH FROM EMPIRE SUSPENSION BRIDGE (LOWER SHOVELS WORKING ON BOTTOM OF CANAL).
JUNE 16, 1913.



CULEBRA CUT, LOOKING SOUTH FROM EAST BANK HALFWAY BETWEEN CULEBRA AND EMPIRE. JUNE, 1913.



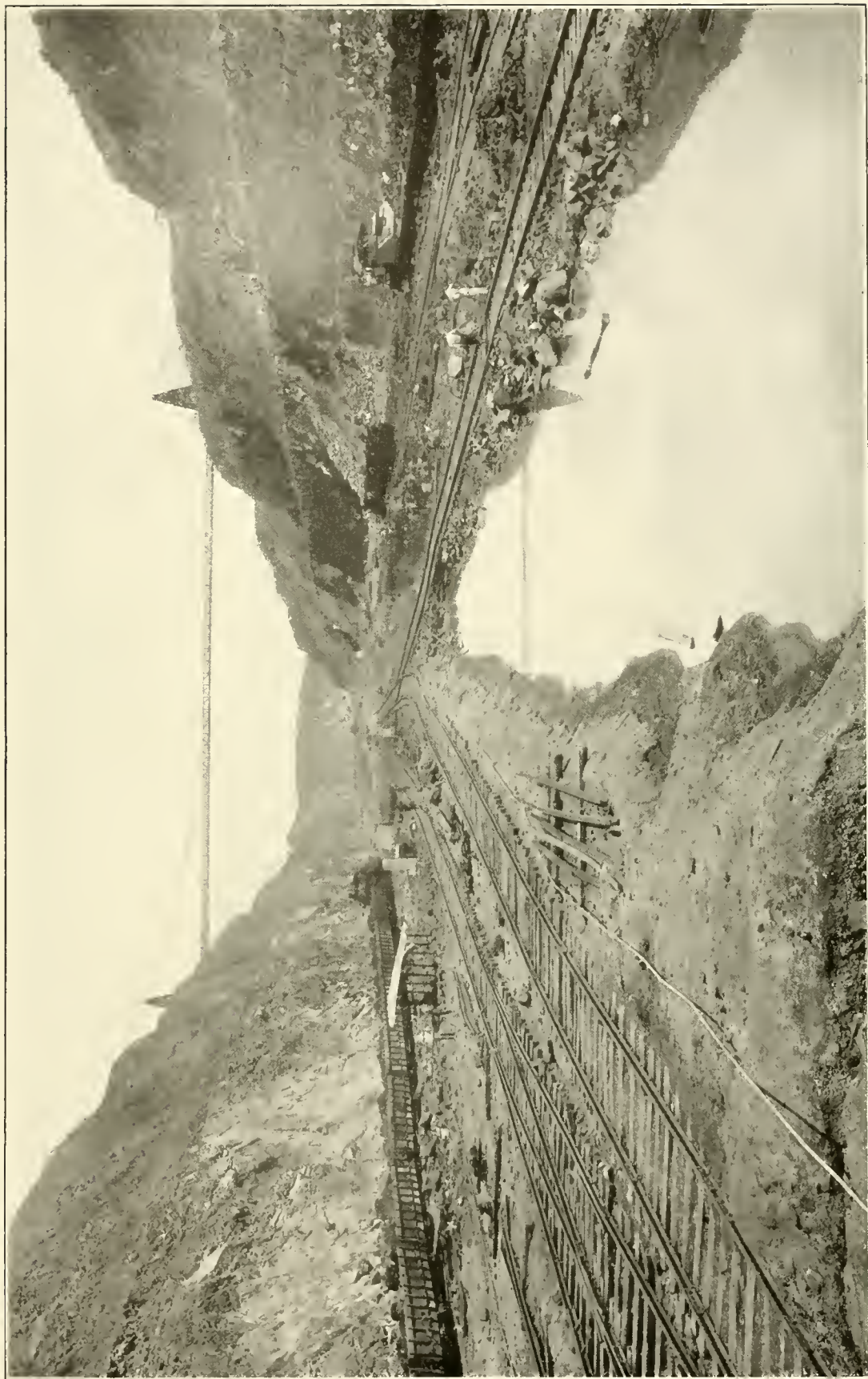
CULEBRA CUT, LOOKING NORTH FROM EAST BANK, SHOWING BOTTOM OF CANAL. AUGUST 23, 1913.



CULEBRA CUT, CULEBRA. LOOKING SOUTH FROM EAST BANK. SURFACE OF WATER 72.3 FEET ABOVE SEA LEVEL.
OCTOBER 30, 1913.



CULEBRA CUT, EMPIRE. LOOKING SOUTH FROM SUSPENSION BRIDGE. SURFACE OF WATER 72.3 FEET ABOVE SEA LEVEL.
OCTOBER 30, 1913.



CULEBRA CUT, LOOKING NORTH FROM ONE-FOURTH MILE SOUTH OF SUSPENSION BRIDGE AT EMPIRE. CUT COMPLETED
AT BRIDGE, JUNE 16, 1913.



CULEBRA CUT, EMPIRE. LOOKING SOUTH FROM WEST BANK NEAR CUNETTE. SURFACE OF WATER 72.3 FEET ABOVE SEA LEVEL. OCTOBER 30, 1913.



CULEBRA CUT, EMPIRE. LOOKING SOUTH, SHOWING SUSPENSION BRIDGE. DECEMBER, 1913.



CULEBRA CUT, CULEBRA. LOOKING SOUTH FROM CONTRACTORS HILL. CUCARACHA SLIDE IN LEFT CENTER. MAY 25, 1913.



CULEBRA CUT, CULEBRA. LOOKING NORTH. LOWER PART OF CUCARACHA SLIDE ON RIGHT. AUGUST 18, 1913.



CULEBRA CUT, CUCARACHA SLIDE. FROM WEST BANK SOUTH OF CONTRACTORS HILL. LOOKING NORTH. OCTOBER 16, 1913.



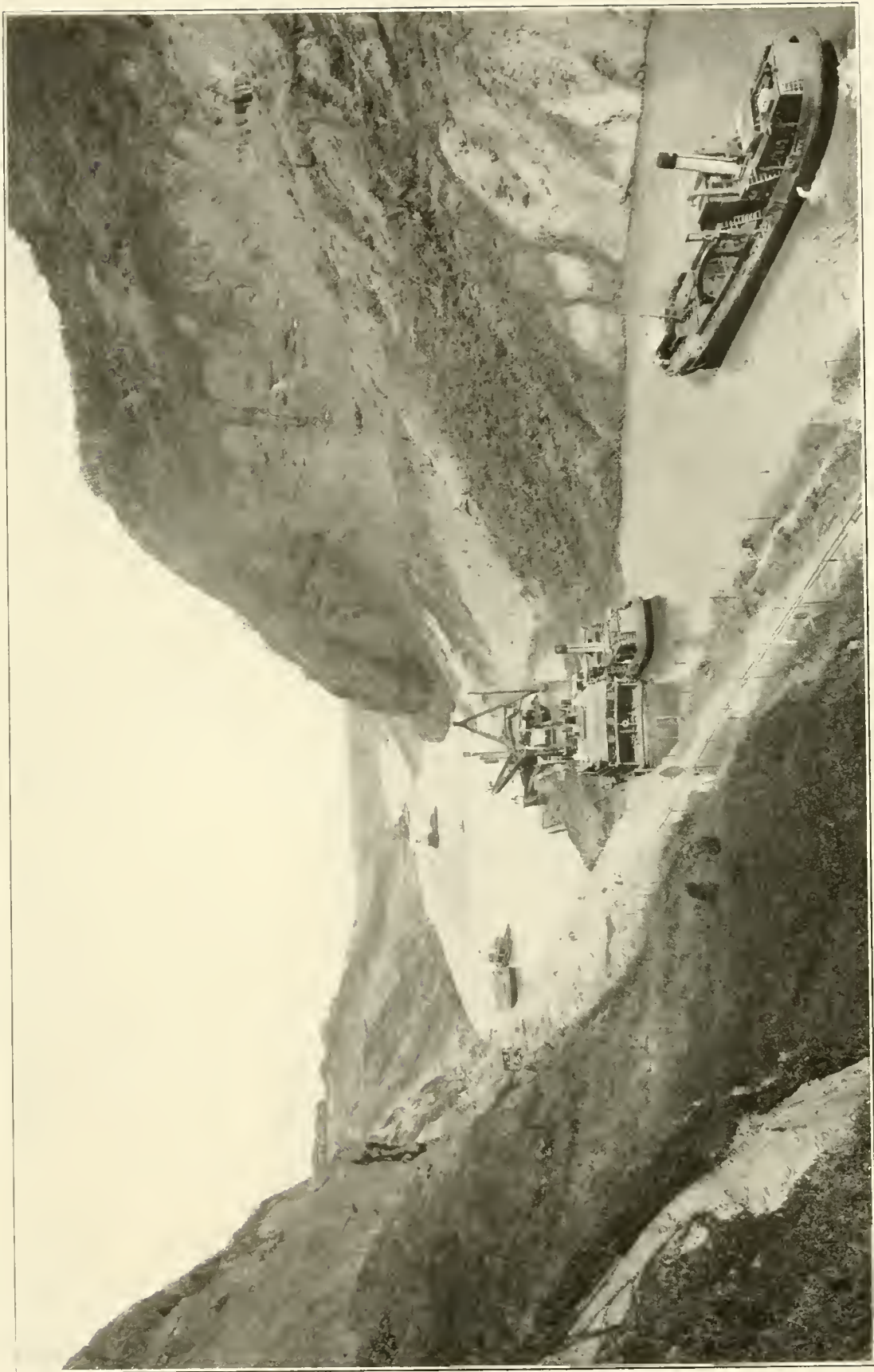
CULEBRA CUT, CULEBRA. BLASTING A CHANNEL THROUGH CUCARACHA SLIDE. LOOKING NORTH. OCTOBER 16, 1913.



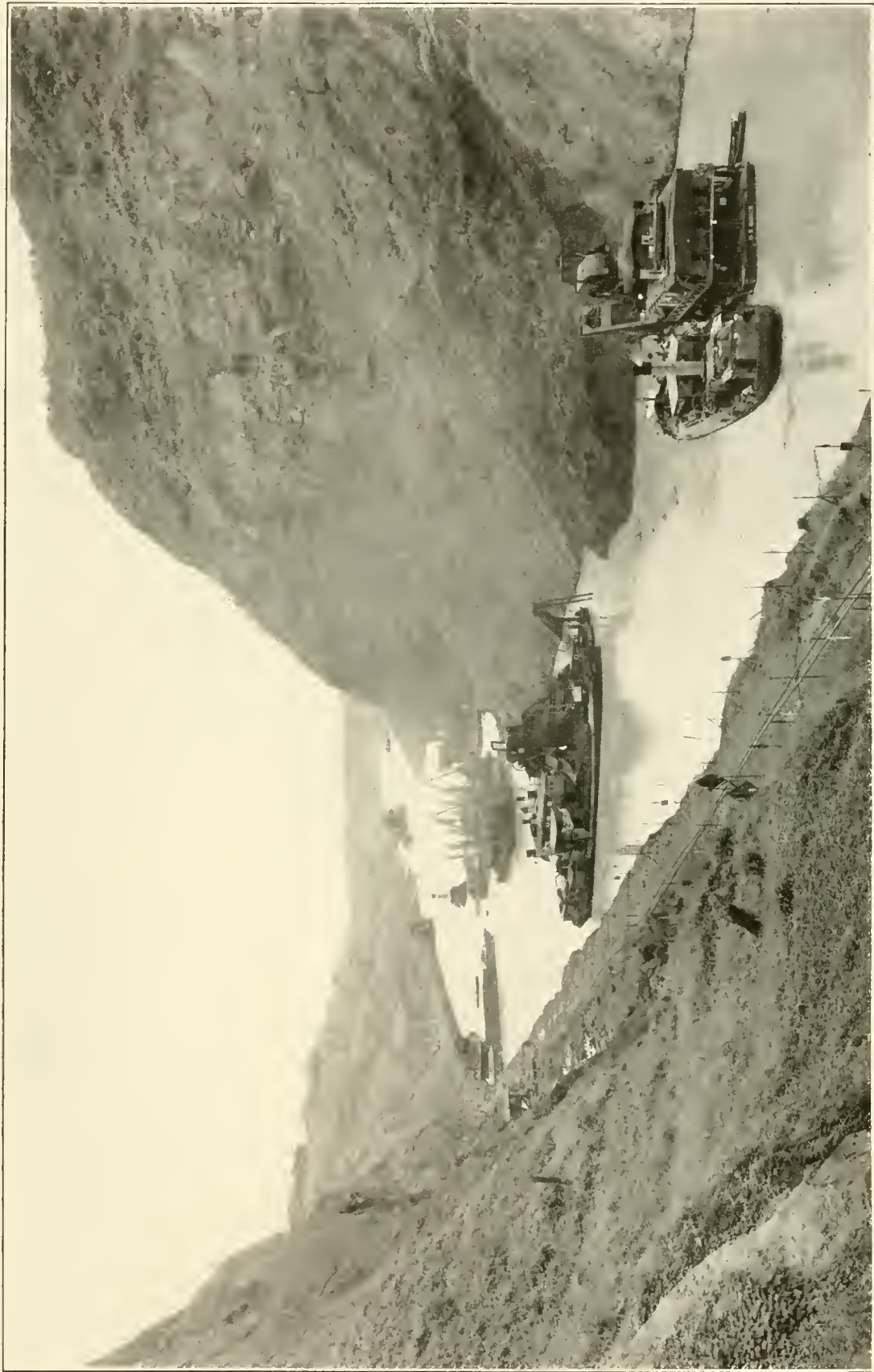
CULEBRA CUT, CULEBRA. LOOKING SOUTH FROM TOP OF CONTRACTORS HILL. CUCARACHA SLIDE TO LEFT.
DECEMBER 3, 1913.



CULEBRA CUT FROM CONTRACTORS HILL, SHOWING LADDER AND DIPPER DREDGES WORKING ON TOE OF CUCARACHA SLIDE, DECEMBER 9, 1913.



CULEBRA CUT, CULEBRA. LOOKING NORTH FROM WEST BANK. DREDGES OPERATING IN CUCARACHA SLIDE. DECEMBER 9, 1913.



CULEBRA CUT. LOOKING NORTH FROM WEST BANK. WIDTH OF CHANNEL AT SLIDE 150 FEET. DECEMBER 18, 1913.



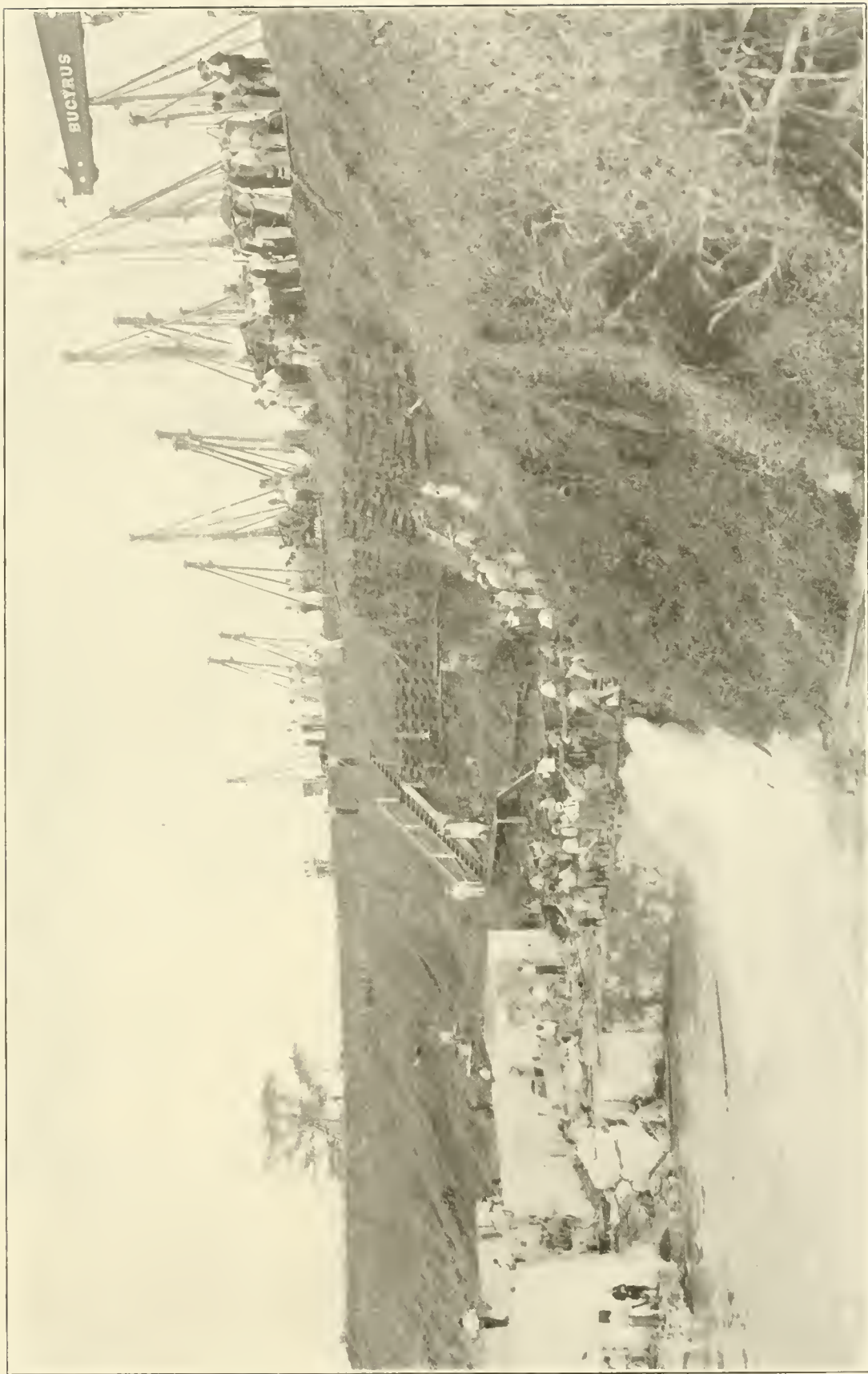
CULEBRA CUT, CULEBRA. SEAGOING SUCTION DREDGE "CULEBRA" PASSING CUCARACHA SLIDE. JANUARY 20, 1914.



CULEBRA CUT, CULEBRA. LOOKING NORTH FROM CONTRACTORS HILL. JUNE 12, 1914.



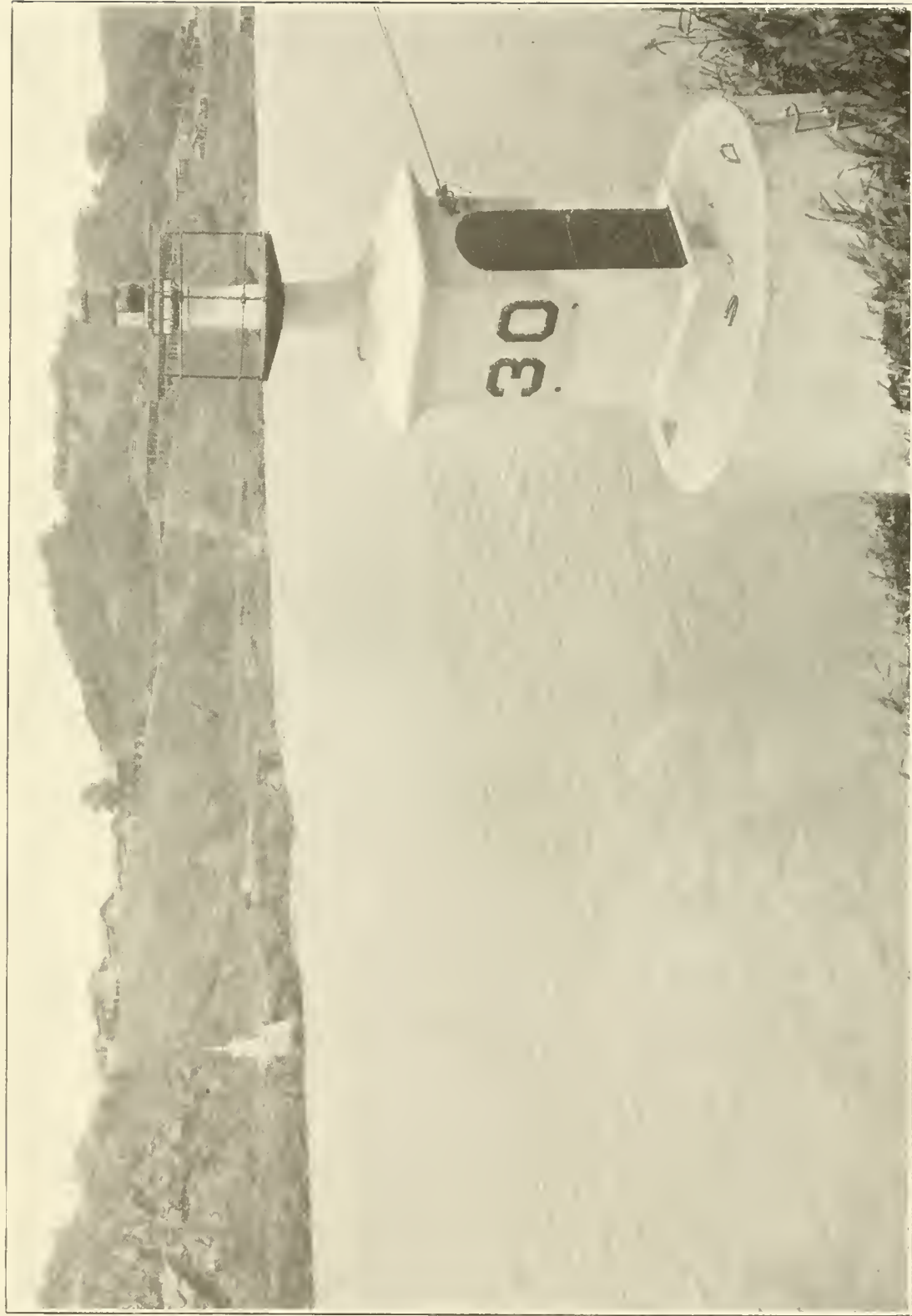
CULEBRA CUT, CULEBRA. LOOKING SOUTH FROM WEST BANK, SHOWING DREDGES WORKING IN CUCARACHA SLIDE.
JUNE, 1914.



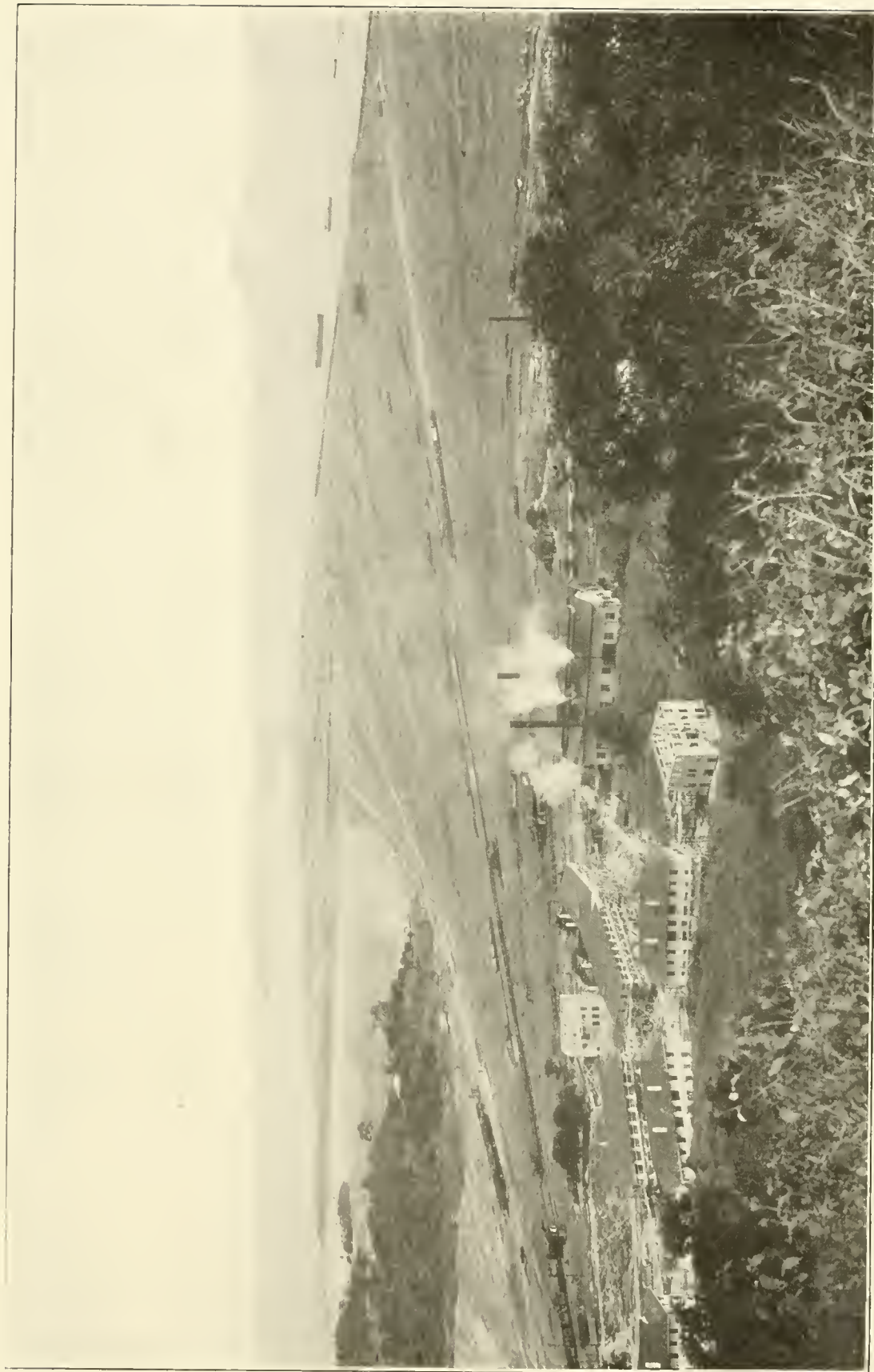
GAMBOA DIKE. OPENING THE VALVES AND FLOODING CULEBRA CUT. WATER COMING THROUGH FOUR PIPES, OCTOBER 1, 1913.



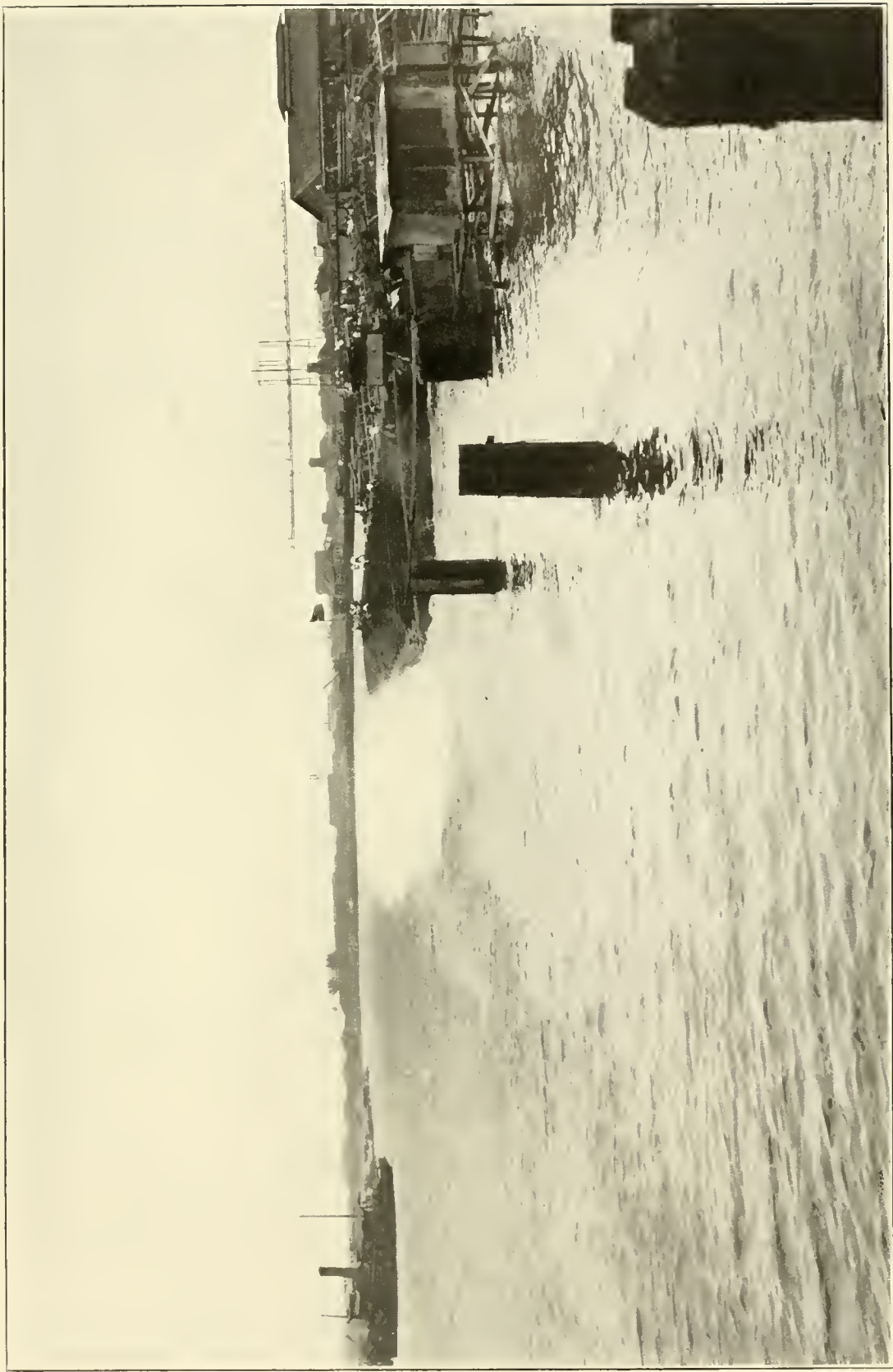
BLOWING UP GAMBOA DIKE, LOOKING NORTH FROM BOAT IN CANAL SOUTH OF DIKE. OCTOBER 10, 1913.



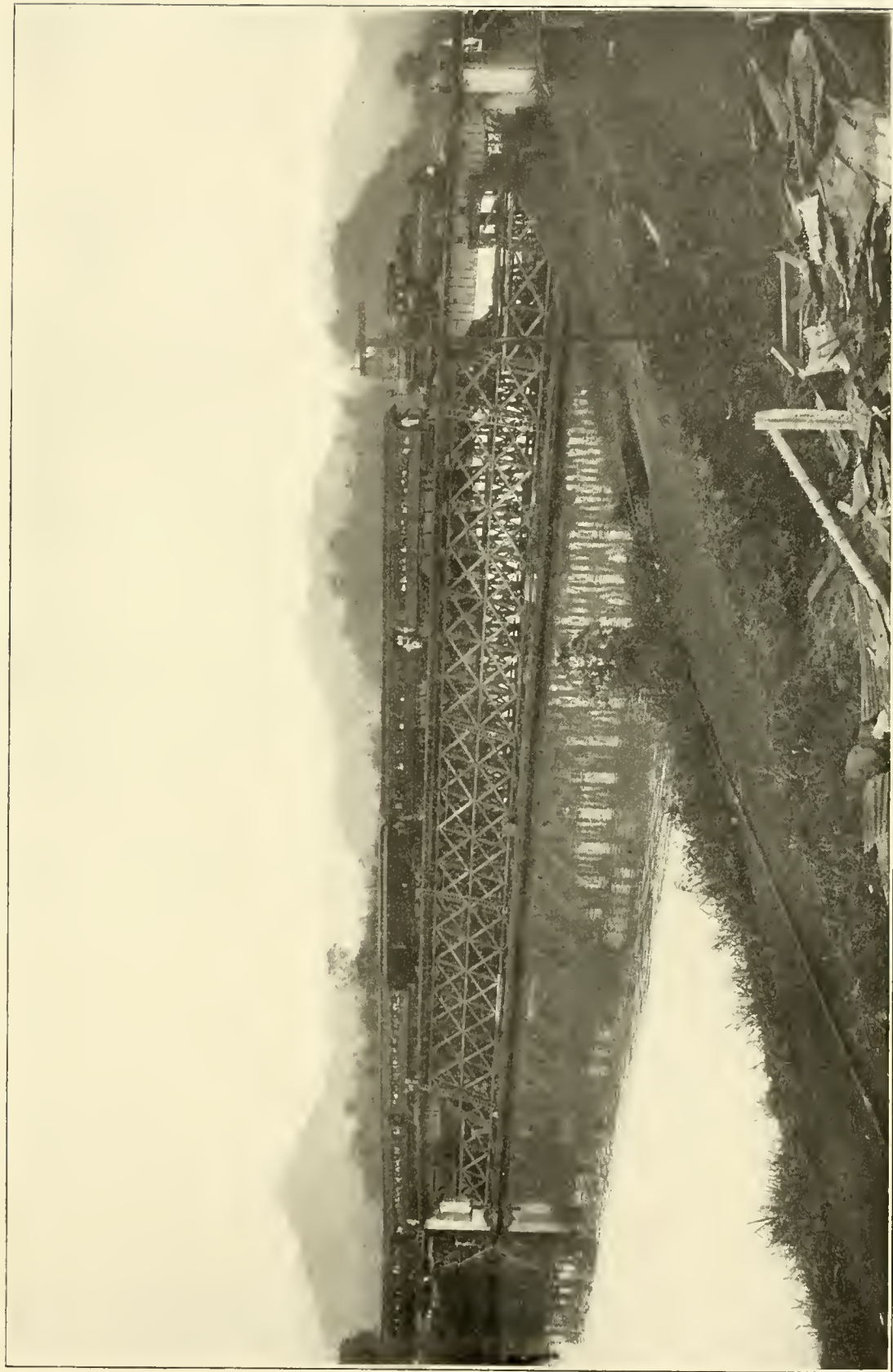
AIDS TO NAVIGATION. BEACONS IN CULEBRA CUT.



NAOS ISLAND BREAKWATER. LOOKING SOUTH FROM SOSA HILL.



PARAISO PONTOON BRIDGE. LAUNCHING PONTOON AT MOUNT HOPE SHOPS. MARCH 25, 1914.



PONTOON BRIDGE, PARAISO, LOOKING NORTH, SHOWING TRAIN CROSSING CANAL. MAY 15, 1914.

WATER HYACINTHS.

The destruction of water hyacinths in the canal, Gatun Lake, and its tributaries was begun in March, 1914, and continued during the remainder of the year.

An outfit consisting of a 30-foot steam launch, a pump boat, and a quarter boat was used. The launch was used to supply steam to the pump boat and for towing and transportation of men and supplies.

An old anchor boat of $3\frac{1}{2}$ feet depth, 11 feet beam, and 24 feet long was outfitted with a 50-gallon boiling tank, a 500-gallon mixing tank, a $3\frac{1}{2}$ by $2\frac{1}{2}$ by 3 inch duplex pump, and a manifold with six hose connections for spraying the plants with an arsenic solution. A larger boat would have been practically useless for the service owing to most of the plants being in shallow water and back among the trees in the overflowed areas.

The arsenic solution used was made up of arsenic, soda, and water, in the proportions of 1 pound of arsenic, 1 pound of soda, and 18 gallons of water. In preparing the solution for use 25 pounds of arsenic, 25 pounds of soda, and 25 gallons of water were placed in the boiling tank and boiled for one hour. It was then run off into the mixing tank and 425 gallons of water added to reduce to the proper strength. Two days after spraying the plants had turned brown in color and in from 8 to 10 days were dead. It was sometimes necessary to give the second spraying where the leaves were very thick in order to kill all the plants. Where the plants were greatly scattered they were pulled up and deposited on shore. Forty-eight thousand five hundred and seventy-eight square yards of hyacinths were destroyed.

DRY EXCAVATION.

CULEBRA CUT.

Excavation by steam shovels was carried on by the central division on the lower levels of the canal prism to September, 1913, and on the high levels until June, 1914.

One hundred and seventy-five thousand eight hundred and fifty-eight cubic yards of earth and 2,946,844 cubic yards of rock were removed from the canal prism; 35,853 cubic yards of earth were excavated for the dredging division relay station; 5,873 cubic yards of earth and 37,292 cubic yards of rock removed at the Paraiso repair wharf; 8,640 cubic yards of earth and 5,640 cubic yards of rock for the fifth division sluiceway at Gold Hill; and 64,482 cubic yards of rock from the pontoon bridge basin and approaches.

SURVEYS.

The usual surveys were made of the dredged areas in the canal prism, Cristobal terminals, Toro Point, Margarita Bay, Coco Solo, Limon Bay, and Balboa inner harbor; cross sections plotted and estimates prepared. The general-progress survey was made every four months.

Topographic surveys were made of Cucaracha slide.

OFFICE.

Routine clerical work, preparation of progress records, estimates, requisitions, etc., was satisfactorily performed during the year.

Dredge excavation.	Unit.	Amount.
In prism.....	Cubic yards...	12,655,171
Auxiliary.....	do.....	2,993,782
Total.....	do.....	15,648,953
Explosives used.....	Tons.....	441
Cement used.....	Barrels.....	115
Rock drilled (submarine).....	Feet.....	242,146

Respectfully submitted.

W. G. COMBER,
Resident Engineer.

Col. GEO. W. GOETHALS, United States Army,
Governor of the Panama Canal, Culebra, Canal Zone.

APPENDIX D.

REPORT OF THE SUPERINTENDENT—MECHANICAL DIVISION.

BALBOA, CANAL ZONE, *July 31, 1914.*

SIR: In accordance with your circular letter of June 12, 1914, I have the honor to submit the following, relative to the operations of the mechanical division for the fiscal year ended June 30, 1914:

The mechanical division was in charge of Mr. A. L. Robinson until July 19, 1913, when his resignation became effective. Subsequent to that date, and until the undersigned reported for duty, the general duties relating to organization and personnel were performed by Lieut. Col. T. C. Dickson, United States Army, inspector of shops, while the operation of the shops themselves was under the supervision of the assistant superintendent, Mr. John J. Eason. The undersigned assumed the duties of superintendent January 26, 1914, and as such took over all the duties performed by Col. Dickson in connection with the mechanical division. Upon Col. Dickson's detachment, March 7, 1914, his general inspection duties were either assigned to other divisions or allowed to lapse. Owing to the almost complete consolidation of shops, the duties of a general inspector of shops were no longer required, and the design and construction of the new shop buildings at Balboa had advanced to a stage which permitted them to be carried on by other means.

Under the present organization, the superintendent, assistant superintendent, mechanical engineer, chief clerk, and traveling engineer are considered as on general duty in the division, while all other employees are specially assigned to particular shops, although foremen, clerks, and mechanics are subject to detail from one shop to another by the superintendent, as the best interests of the work as a whole require. In addition to his general duties, the assistant superintendent is in direct charge of the Balboa shops.

At the end of the fiscal year the establishments under operation by the division consisted of the Balboa shops (including roundhouse and car shops), the Cristobal shops (and dry dock), the Paraiso shops, the Cristobal roundhouse, and small hostling establishments at Gatun, Empire, and Paraiso (the last named being under the charge of the foreman at Paraiso shops), and car-inspecting establishments at Cristobal and Balboa.

The Balboa shops.—The foundry and planing mill were moved to the new buildings at these shops direct from Gorgona, operations being begun in the planing mill on July 29, 1913, and in the foundry August 14, 1913. No other shops were occupied, except for the performance of work in connection with shop erection and minor work originating in the immediate vicinity, until the abandonment of Empire, on and after March 1, 1914. The Balboa shops are in special charge of the assistant superintendent, Mr. John J. Eason, assisted by Mr. S. G. Shearer, general foreman of the machine department; Mr. A. O.

Herman, general foreman car shops and woodworking department; and Mr. J. M. Abston, foreman of the roundhouse. In the machine department there is a night general foreman, Mr. C. S. Perry, and in the roundhouse a night foreman, Mr. P. S. Cone. All the foundry work, planing-mill work, and car work for the whole Isthmus are performed at this establishment, also all the hostling at the south end of the canal. In addition, all heavy repairs to locomotives are performed here, and the office of the superintendent is located here. The superintendent's office was moved from Empire February 25, 1914, and, beginning March 1, all shops were moved from Empire as rapidly as provision could be made for carrying on the large amount of work under way. The last shop moved was the instrument repair shop, which was moved May 7, 1914. At the end of the fiscal year construction work and grading were still uncompleted, and work was still being performed under considerable difficulties. When all the construction work and grading have been completed and when the additional tools mentioned later have been provided, the canal will possess in the Balboa shops one of the best shop establishments in existence, with capacity for performing all the work likely to be demanded of it under operating conditions. The buildings are of steel and concrete construction, of the most permanent design. The tools, while mostly obtained from the various shop establishments previously in existence on the Isthmus, have been fitted with individual electric drive where desirable, and have otherwise been materially modernized. They have been supplemented by a number of large new tools, including a 500-ton forging press, a 150-ton pneumatic riveter with a 12-foot gap, a 96 by 132 inches by 24 feet open side extension planer, and by other modern tools of smaller size; and additional tools will be required, as mentioned later in this report, for special work liable to be required on ships. No general description of the buildings or arrangement of the plant is included here, as it is understood that this data will be supplied in the report of the engineer of terminal construction, under whose supervision the construction work is being performed.

The Cristobal shops and dry dock continued in operation throughout the year under the supervision of General Foreman C. J. Reilly. This plant, being the only one where a dock was available, has been charged with all repairs to floating equipment for which a dry dock was necessary. These requirements were so great that the dock was in practically continuous use throughout the year, and, on account of its not being available for the purpose, it was necessary to dock the five submarines of the C class in the easternmost upper lock at Gatun. This was done March 9, 1914, and later, when the flooding of compartments due to an explosion in the fuel oil tanks on the *Corozal* made the draft of that vessel greater than could be taken into the dry dock, she also was docked in the same lock with the submarines on March 17, 1914. The submarines were flooded to an extent permitting them to remain in their cradles while the water was raised to sufficient depth to permit docking the *Corozal*.

Dredge and submarines were all undocked together on April 11, 1914. The plant at Cristobal, while it possesses a few good tools, is in general of old design and not in good condition. The buildings are of wood, generally in poor repair, and the dry dock needs considerable work to place it in thoroughly efficient condition. Steps looking to

the modernization of the plant have been deferred, partly on account of the difficulty of the work, due to the large amount of repair work under way on dredging equipment, and partly with a view to finding out what the demands on the shops are likely to be under operating conditions of the canal. It is proposed, however, to apply electric drive to the principal tools as soon as current can be obtained from the hydroelectric plant at Gatun. This will involve small cost and will be justified by the saving possible during the period for which the operation of the plant will be necessary for the performance of work now in sight. Ninety-seven vessels were placed in the dry dock during the year.

The Paraiso shops were reestablished on October 22, 1913, primarily for the performance of work on dredging equipment operating in the Culebra Cut. The plant, as installed, is valued at about \$20,000 and is under the direct charge of Mr. James Macfarlane, superintendent of dredging, who is answerable to the superintendent of the mechanical division for his duties in connection therewith. The large amount of work necessary on the equipment employed on Cucaracha slide has kept these shops busy ever since they were established, and present prospects are that it will be impossible to close them for several months yet to come. The hostling of four engines operating in this locality was turned over to these shops on May 25, 1914, and is performed under the foreman machinist.

The Cristobal roundhouse was turned over to the mechanical division on April 1, 1914, and all hostling at the north end of the canal was concentrated there. The establishment, in addition to the roundhouse, comprises a small boiler plant and two air compressors with a combined capacity of about 2,000 feet per minute. This plant supplies air for hostling purposes and also for work on the new piers for the Panama Railroad. It is of inefficient design and in relatively poor condition, and it is proposed to abandon it as soon as arrangements can be made for supplying air from the Cristobal shops. The buildings are all of wood. The roundhouse itself is in fair condition, but the coal chute is in need of considerable repairs. In view of the decreased number of engines to be hostled and the relatively large percentage of these which will use oil fuel, it is proposed to tear down this chute and to coal engines with shovels. This method has been found about the least expensive of any and will, in my opinion, be most efficient for this particular plant. With the establishment of the Balboa roundhouse the performance of major repairs to locomotives at the Cristobal roundhouse was discontinued and its activities confined to hostling and minor repair work. Mr. W. H. Readle was in charge of this plant.

When it was decided to remove additional material from the east bank of the canal near Rio Grande it became necessary to establish a small hostling plant at Empire in the shops vacated March 1. The number of engines to be hostled has decreased until it is now proposed to combine them with the establishment at Paraiso. This hostling is under the charge of Assistant Foreman J. A. O'Brien.

Another small hostling establishment was placed in operation June 16, 1914, at Gatun, in order to provide for the engines in this vicinity subsequent to the abandonment of the machine shops at this point. This establishment at the end of the year was in charge of Assistant Foreman S. G. Allen.

The car inspection at Cristobal and Mount Hope has been under the direction of Assistant Foreman William Markham, while that at Panama and Balboa was supervised directly by the general foreman of the car shops and woodworking department.

Owing to the rise of water in Gatun Lake, it became necessary to abandon the Gorgona shops in August, 1913. The planing mill was abandoned July 7, and was reestablished at Balboa July 29. The foundry was abandoned August 13, and began operations at Balboa the next day. The other shops were transferred to Empire, the whole plant being completely abandoned by August 20, 1913. The work was carried out in accordance with circular No. 349-E, dated June 25, 1913. As the shops were vacated such machine tools as were suitable for installation in the new shops at Balboa were reserved for that purpose, the remainder being either reinstalled at other shops or surveyed and turned over to the supply department for sale. With the abandonment of Gorgona shops the Empire shops became the principal shops on the Isthmus and continued as such until their removal to Balboa.

In accordance with circular No. 349-F, dated January 2, 1914, the abandonment of the Empire shops was begun February 25, 1914, when the offices of the division were removed to Balboa. Beginning March 1, 1914, the forces of the various shops were removed as the work could be assumed at Balboa, the final shop to move being the instrument repair shop, transferred May 7, 1914. The removal of all of the other shops had been completed on April 6, 1914, with the removal of the car shops. Such machine tools and other equipment of the Empire shops as were suitable for installation at Balboa were removed and reinstalled at that place. The remainder were surveyed and condemned for sale or for other disposition, and the buildings were turned over to the quartermaster on April 24, 1914.

With the establishment of the electrical division on April 1, 1914, the electric plants at Empire, Miraflores, Gatun, and Balboa were turned over to that division, together with the operating forces, headed by Mr. Hartley Rowe, electrical superintendent. Inasmuch as each of these plants contained air compressors and it was uneconomical to separate their operation from that of the electric units, these air compressors were likewise turned over to the electrical division and were operated by that division for the remainder of the fiscal year. It is expected, however, that when the mechanical division air compressors are installed at Balboa and when current from Gatun or Miraflores becomes available, the Balboa electric and air-compressor plants will be abandoned and all air in that district furnished by the mechanical division from the new electric-driven plant adjacent to the shops. By establishing a small electric-driven air-compressor plant at the Paraiso shops the greatly decreased demands for compressed air in this district will be cared for by the mechanical division, and the Empire plant, both electric and air, suspended about August 1, 1914. The air-compressor plant at Miraflores will doubtless continue for the much reduced compressed-air service in that vicinity. The establishment of the electrical division accounts almost entirely for the decreased expenditures under the mechanical division shown by the tables for April, May, and June.

The old "shipways" shops, formerly operated by the dredging division, were turned over to the mechanical division October 22, 1913, and were operated thereafter for the performance of a limited amount of work originating in the vicinity, mostly in connection with construction of the new shops. They were so located as to interfere with the construction of extension runways for the overhead cranes in the permanent shops and dry docks at Balboa, and, upon the removal of the shops from Empire, the work done in them was transferred to the new shop buildings and the old buildings and tools removed. The last building was torn down in April.

The machine shops and engine house at Gatun were operated for work in connection with the installation of lock machinery and caring for locomotives engaged in that vicinity. They were abandoned April 1, 1914, and the work transferred to Balboa or Cristobal.

A hostling establishment at Cocoli was placed in operation in September, 1913, to care for locomotives engaged in handling spoil on the west bank of the canal in that vicinity. This establishment was abandoned March 14, 1914, when the excavation at that point was completed. The tools were removed, and the buildings turned over to the supply department.

During the earlier part of the fiscal year the French engines in use on the east bank of the canal opposite Culebra were hostled on the work near the Empire suspension bridge. The American engines were hostled at Las Cascadas or Pedro Miguel until the removal of the Gamboa Dike, when the work was transferred elsewhere. The Las Cascadas engine house was abandoned November 11, 1913, on completion of the dry excavation in Culebra Cut and the consequent reduction in the number of locomotives to be cared for. The buildings were turned over to the Tenth Infantry April 17, 1914.

Owing to the rise of water in Miraflores Lake, the Pedro Miguel engine house was abandoned September 15, 1913. The greater portion of the equipment was moved to the Gold Hill engine house, and the remainder to other shops or surveyed for sale or other disposition. The buildings were turned over to the quartermaster's department and torn down.

An engine house was established at Gold Hill in September, 1913, to care for the equipment engaged in dry excavation back of Gold Hill. This engine house continued in operation until the completion of the excavation work, and was finally discontinued March 31, 1914. The machine tools were surveyed for removal to other points or for sale and the buildings turned over to the quartermaster's department April 24, 1914.

The air-compressor plant at Rio Grande, which had been in operation since 1905, was shut down on October 15, 1913, on account of reduction in air consumption in that district. Such compressed air as was required thereafter was supplied from the plant at Empire. Such portion of the boilers and auxiliary machinery as could be used to advantage at other points was removed, and the remainder of the plant, together with the buildings, was turned over to the quartermaster's department.

The Cristobal car shops were in operation until March 7, 1914, when they were abandoned and all car work concentrated at the

Balboa shops. A part of the buildings were turned over to the quartermaster's department in March, 1914, but the old car shed and paint shop were retained, the former for sheltering passenger equipment while being cleaned, the latter for the storage of the special cars, sight-seeing cars, and pay cars.

An engine house on the Balboa dumps was established September 15, 1913, to care for the locomotives employed in that vicinity. This, until it was closed, May 24, 1914, took care of about 70 locomotives. When it was closed, the hostling work was transferred to the new Balboa roundhouse and the buildings turned over to the quartermaster's department.

When the Balboa roundhouse was placed in service, on April 1, 1914, the Panama roundhouse of the Panama Railroad was placed out of use.

The Balboa dump car shop was established October 15, 1913, for repairs on dump cars and Lidgerwoods in use in that vicinity. On April 30, 1914, the work was transferred to the new car shops at the Balboa plant and the buildings turned over to the supply department.

During the fiscal year the work on the dry docks at Balboa was continued under the engineer of terminal construction, and upon completion those docks, with the pumping plant connected therewith and the air-compressor plant to be installed in the same building, will be operated by the mechanical division. The two 250-ton floating derricks were about to be delivered when the fiscal year closed, and an organization has been approved for their operation under the mechanical division.

On April 1, 1914, the traveling engineer was transferred to the mechanical division, and subsequent to that date the responsibility for the condition of all mechanical equipment on the Isthmus belonging to the Panama Railroad and The Panama Canal, with the exception of floating equipment, power plants, cold-storage plant, pumping plants, and lock equipment rested with the mechanical division.

Throughout the whole year, while the shops were in operation at all, two shifts were regularly worked at Gorgona, Empire, Paraiso, and Balboa. The second shift had been discontinued at the Cristobal shops on October 26, 1912, but, on account of the large increase in work on dredging equipment, effective when wet excavation opposite the Cucaracha slide began, it became necessary on August 18, 1913, to again establish the night shift in these shops, and this shift was continued till the close of the fiscal year. The regular hours of work were from 7 a. m. to 11 a. m. and 1 p. m. to 5 p. m. for the day shift, and from 5 p. m. to 1 a. m. for the night shift. In addition to the double shift, emergencies continually arose which necessitated large amounts of overtime work in order that equipment might be kept in condition for the most efficient use and in order to prevent delay in the work of the other divisions.

Due to the consolidation of all mechanical work under the mechanical division the expenditures for the fiscal year 1914 were greater than for any other fiscal year, notwithstanding the retirement of various equipment and the closing up of numerous shops. The

maximum expenditures were made during the month of February, 1914, and amounted to \$538,270.05, of which \$231,654.72 were expenditures on the pay roll. Totals of expenditures for regular and overtime work for the division as a whole, and for the Cristobal and Paraiso shops are given in the tables attached. Due to the short periods during which shops other than those at Cristobal and Paraiso were operated separate tables of expenditures of these shops are not included.

The maximum number of employees in the mechanical division during the fiscal year was during March, when there were 1,126 on the gold roll and 2,779 on the silver roll. The minimum number employed was in June, 1914, and comprised 928 on the gold roll and 2,400 on the silver roll. This reduction, as stated above, was in part due to the decrease in the amount of work performed, but was mostly due to the establishment of the electrical division and the transfer to it of the various power plants and the electrical work. The force employed July 1, 1913, was 974 on the gold roll and 2,360 on the silver roll, and the force June 30, 1914, was 942 on the gold roll and 2,452 on the silver roll.

The work of the division as a whole has decreased somewhat during the past three months. Especially is this decrease noticeable in the planing mill and foundry, but it is expected that marked decrease in practically all shops, except those at Cristobal and Paraiso, will take place from now on. The prospective inauguration of a service for transporting rock from Sosa Hill for the East Breakwater involves rebuilding about 700 Lidgerwood cars, which work is now under way in the car shops at Balboa. Keeping these cars, and the engines used for hauling them, in good repair will provide a large amount of work. In addition, there will be a large amount of work on caissons, steel-work, and installation of machinery in connection with dry docks, coaling plants, etc. It is hoped that this can be arranged so as to avoid overtime work and to minimize work in more than one shift,

Owing to lack of available quarters in the vicinity of the Balboa shops, it was necessary to maintain labor train service from Empire and Panama subsequent to March 1. The completion of permanent quarters and the removal and reerection of quarters from other parts of the Isthmus in Ancon and Balboa will, it is hoped, permit discontinuance of some of the labor trains from Panama on August 1, and of all labor trains from Empire not later than September 1, 1914. This lack of quarters has been the source of considerable hardship for employees, but has, in general, been borne with good nature.

With a view to determining actual costs, and to permit these costs to be kept in such manner that the most efficient results may be accomplished, a new accounting system was authorized for the division. This accounting system was effective for the Balboa shops on April 1, 1914, and modification of the same for the Cristobal shops and Paraiso shops on July 1, 1914. Owing to the comparatively simple organization of these two latter shops it was not deemed desirable to record costs in such detail as for the larger and more complicated organization at Balboa. The systems are, however, identical in principle, and provide for recording costs by shops, the

various items of overhead being distributed to accounts in sufficient detail to permit ready analysis and the lopping off of unnecessary expense. The advantages are as enumerated below:

- (1) Distribution of overhead expense on an exact rather than an arbitrary basis.
- (2) The determination of costs by shops.
- (3) The adoption of the machine rate basis of distribution instead of the labor basis in all shops that are adapted to the use of a machine rate.
- (4) The elimination from the accounts of the mechanical division of the proportionate cost of general overhead expenses incurred outside of the mechanical division, such as "General administration," "Storekeeping and purchasing," "Civil government," and "Department of health." This overhead is handled entirely by the auditor's office and percentages supplied for application to bills for outside parties.
- (5) The adoption of a standard schedule of symbols for shop expenses.
- (6) The adoption of a tonnage basis of distribution of overhead instead of labor basis in those shops in which the tonnage basis is adaptable.
- (7) The charging to cost of product of estimated allowances for repairs and for depreciation of buildings, machinery, and equipment in order to provide reserves to meet the cost of repairs and cost of replacements.

The system as authorized is in accordance with the best accounting systems in vogue in the United States at this time, and, while it involves somewhat more clerical work, the additional cost will be much more than compensated for by the increased efficiency resulting.

In connection with the establishment of this accounting system, as well as with the installation of tools and equipment at the Balboa shops in accordance with the most modern practice, Naval Constructor C. W. Fisher, United States Navy, rendered great service until his detachment from duty June 28, 1914. While not assigned to the mechanical division, Mr. Fisher's work was almost entirely for its benefit, and was performed in direct consultation with the inspector of shops, the assistant superintendent, or myself. Mr. Fisher's previous duties in connection with so-called "scientific management" at two of the largest navy yards in the United States especially well qualified him for the performance of the work done by him during the last few months of his stay here, and the results accomplished promoted to a large extent the probable efficiency of the Balboa shops.

The closing up of excavation work generally throughout the Isthmus has resulted in large excess of equipment for dry excavation. During the year the following apparatus was surveyed and retired, either for sale or for shipment elsewhere.

Locomotives:	
101 class.....	24
201 class.....	13
301 class.....	27
601 class.....	15
	— 79
Oliver dump cars.....	113
Western dump cars.....	256
Lidgerwood flat cars.....	280
Spreaders.....	6
Unloaders.....	11
Track shifters.....	1
Pile drivers.....	2
Locomotive cranes.....	7

This leaves in actual service, or awaiting survey for retirement, the following equipment:

Class.	Panama Canal.	Panama R. R.
Locomotives:		
1-100.....		6
201.....	61	15
301.....	3	3
401.....	2	
451.....	8	2
501.....	9	
601.....		5
651.....		12
701.....	9	
801.....	6	
Oliver dump cars.....	98	43
Western dump cars.....	609	68
Lidgerwood flat cars.....	590	52
Spreaders.....	1,369	121
Unloaders.....	12	2
Track shifters.....	15	
Pile drivers.....	8	
Locomotive cranes.....	10	2
	57	3

In order to provide facilities for repairs to ships, several large tools not hitherto necessary will be required. Among these may be mentioned a 65-foot lathe for turning shafts, a 30-foot plate-planing machine, a pair of heavy rolls, a hydraulic plate-bending machine, and a hydraulic flanging press. In addition, there should be a number of smaller tools provided with special reference to ship work. The above-mentioned tools, while not immediately necessary, are liable to be required at any time subsequent to the opening of the canal to commerce. It is estimated that \$100,000 should be made available for the purchase and installation of these tools.

The cessation of work which could be definitely measured on a cubic-yard or other readily comprehended unit basis has removed one of the great incentives to steady application on the part of employees. When each steam shovel was in competition to excavate the maximum yardage, the demand of its crew that its work be not interfered with when it could possibly be avoided was, in itself, one of the best possible inducements to rapid and efficient work in the shops. Its removal necessitates a considerably greater relative number of employees in supervisory positions. The necessity for this increase is evident, not only in the shops, but also in practically every other line of work on the Isthmus. Owing to the unsettled condition under which the mechanical division operated during most of the fiscal year it was not possible to do much so-called efficiency work in the division. The conditions expected to exist will not, in my opinion, justify the application of any of the so-called scientific management systems, but there is room for the adoption of many improved methods which, while not involving hardship on employees, nor excessive cost for supervision, will permit material decrease in costs. If the shops are to obtain sufficient work from outside parties to permit the retention of a force large enough for their efficient operation, every possible advantage must be taken to insure efficient management, since, with the high wages likely to

continue in force, at least until June 30, 1916, only efficient management can reduce costs to a point where any but absolutely necessary work can be expected from ships using the Canal. In order to facilitate the authorization and completion of any work which may be desired by such vessels, the regulations have been modified so that work for private parties may now be authorized and begun as quickly in the shops of the mechanical division as in any private establishment, and considering the distance of the Isthmus from any large repair establishments, it is hoped that large use will be made of the canal's repair and docking facilities.

Tables as follows, showing various phases of the operations of the mechanical division for the fiscal year 1914, are attached. Plate No. 142 shows the organization effective July 1, 1914.

Table	1. The value of work performed monthly by mechanical division.
	2. The value of work performed monthly by mechanical division for individuals and companies.
	3. The value of work performed monthly by mechanical division, exclusive of the dry-dock shops and Paraiso shops.
	4. The value of work performed monthly by mechanical division, exclusive of the dry-dock shops and Paraiso shops, for individuals and companies.
	5. The value of work performed monthly by Cristobal Dry Dock shops.
	6. The value of work performed monthly by Cristobal Dry Dock shops, for individuals and companies.
	7. The value of work performed monthly by Paraiso shops.
	8. The value of work performed monthly by Paraiso shops for individuals and companies.
	9. Total overtime of the mechanical division, exclusive of the dry-dock shops and Paraiso shops.
	10. Total overtime of the dry-dock shops.
	11. Total overtime of the Paraiso shops.
	12. The actual shop expense percentage, mechanical division, by principal shops.
	13. The applied shop expense percentage, mechanical division, by principal shops.
	14. The output and cost, brass castings.
	15. The output and cost, iron castings.
	16. The output and cost, steel castings.
	17. Number of repairs to locomotives.
	18. Number of repairs to equipment other than locomotives.
	19. Number of shop and field repairs to different classes of cars.
	20. Amount of equipment hostled, and the cost.

Respectfully submitted.

D. C. NUTTING,
Superintendent Mechanical Division.

Col. GEO. W. GOETHALS, United States Army,
Governor of the Panama Canal, Balboa Heights, Canal Zone.

TABLE NO. 1.—*Value of work performed by the entire mechanical division, including Balboa, Paraiso, and Cristobal Dry Dock shops, during fiscal year—Abstract of expenditures.*

Month.	Labor.	Material.	Services rendered by other divisions and departments.	Total.
1913.				
July.....	\$225,384.35	\$216,428.92	\$32,517.78	\$474,331.05
August.....	229,649.98	192,678.38	48,676.56	471,004.92
September.....	223,451.78	222,916.73	36,177.23	482,545.74
October.....	229,282.40	162,248.06	44,557.40	436,087.86
November.....	226,897.33	210,706.94	41,873.43	479,477.70
December.....	244,947.16	212,289.35	50,294.89	507,531.40
1914.				
January.....	249,089.77	205,095.71	57,152.54	511,338.02
February.....	231,654.72	263,844.08	42,771.25	538,270.05
March.....	270,438.60	187,708.05	41,400.23	499,546.88
April.....	208,317.40	181,600.42	62,064.20	451,982.02
May.....	203,425.93	142,469.50	81,725.17	427,620.60
June.....	208,100.77	159,591.27	113,675.52	481,367.56
Total.....	2,750,640.19	2,357,577.41	652,886.20	5,761,103.80

TABLE NO. 2.—*Value of work performed monthly during fiscal year by entire mechanical division, including Balboa, Paraiso, and Cristobal Dry Dock shops, for individuals and companies.*

Month.	Other than Panama R.R.	Panama R.R.	Total.
1913.			
July.....	\$3,145.69	\$47,471.96	\$55,617.65
August.....	4,417.06	38,455.22	42,872.28
September.....	1,856.92	29,944.76	31,801.68
October.....	7,966.83	31,620.56	39,587.39
November.....	11,094.38	40,751.44	51,845.82
December.....	17,750.62	37,344.84	55,095.46
1914.			
January.....	17,162.06	37,181.91	54,343.97
February.....	11,908.19	25,036.81	36,945.00
March.....	12,596.63	24,135.53	36,732.16
April.....	23,521.36	53,910.85	77,432.21
May.....	1,845.98	67,783.37	69,629.35
June.....	1,850.04	71,367.04	73,217.08
Total.....	120,115.76	505,004.29	625,120.05
Average per month.....	10,009.65	42,083.69	52,093.34

TABLE NO. 3.—*Value of work performed during fiscal year by mechanical division, exclusive of Cristobal Dry Dock shops and Paraiso shops—Abstract of expenditures.*

Month.	Labor.	Material.	Services rendered by other divisions and departments.	Total.
1913.				
July.....	\$207,296.54	\$200,115.24	\$30,077.13	\$437,488.91
August.....	209,321.01	169,981.92	42,488.03	421,790.96
September.....	199,672.39	207,480.83	25,208.58	432,361.80
October.....	206,238.97	150,345.51	40,015.24	396,599.72
November.....	195,871.60	190,120.25	36,129.31	422,121.16
December.....	207,635.36	180,530.80	40,914.91	429,081.07
1914.				
January.....	205,374.72	184,202.99	40,509.14	430,086.85
February.....	186,781.56	240,135.37	40,591.26	467,508.19
March.....	212,538.53	164,552.41	35,188.24	412,279.18
April.....	156,612.48	143,789.05	56,024.52	356,426.05
May.....	152,994.49	118,390.83	67,615.11	339,000.43
June.....	152,305.69	131,318.74	69,824.24	353,448.67
Total.....	2,292,643.34	2,080,963.94	524,585.71	4,898,192.99
Average per month this year.....	191,053.61	173,413.66	43,715.48	408,182.75
Average per month last year.....	201,708.39	183,047.53	13,846.72	398,602.64

TABLE NO. 4.—*Value of work performed during fiscal year by mechanical division, exclusive of Cristobal Dry Dock shops and Paraiso shops, for individuals and companies.*

Month.	Other than the Panama R. R.	Panama R. R. Co.	Total.
1913.			
July.....	\$6,906.34	\$45,682.10	\$52,588.44
August.....	4,048.18	37,039.83	41,088.01
September.....	1,163.02	27,793.69	28,956.71
October.....	6,475.88	29,193.77	35,669.65
November.....	10,756.10	38,389.00	49,145.10
December.....	16,071.29	35,051.21	51,122.50
1914.			
January.....	15,918.66	34,765.08	50,683.74
February.....	6,979.83	22,813.18	29,793.01
March.....	7,364.52	22,432.80	29,797.32
April.....	20,357.58	52,333.67	72,691.25
May.....	1,318.89	65,541.31	66,860.20
June.....	1,642.38	67,997.69	69,640.07
Total.....	99,032.67	479,033.33	578,036.00
Average per month this year.....	8,250.22	39,919.44	48,169.66

TABLE NO. 5.—*Value of work performed during fiscal year by Cristobal Dry Dock shops—Abstract of expenditures.*

Month.	Labor.	Material.	Services rendered by other divi- sions and departments.	Total.
1913.				
July.....	\$18,087.81	\$16,313.68	\$2,440.65	\$36,842.14
August.....	20,328.97	22,696.46	6,188.53	49,213.96
September.....	23,779.39	15,435.90	10,968.65	50,183.94
October.....	23,043.43	11,902.55	4,542.16	39,488.14
November.....	19,147.33	16,493.47	1,703.93	37,344.73
December.....	22,989.74	26,018.22	7,168.90	56,176.86
1914.				
January.....	26,391.42	17,009.95	13,943.98	57,345.35
February.....	31,131.92	17,429.86	1,807.02	50,368.80
March.....	41,456.12	14,442.26	3,524.19	59,422.57
April.....	35,097.17	30,606.38	3,184.08	68,887.63
May.....	31,337.27	15,012.92	7,443.10	53,793.29
June.....	32,998.57	8,623.85	37,449.16	79,071.58
Total.....	325,789.14	211,985.50	100,364.35	638,138.99
Average per month this year.....	27,149.10	17,665.46	8,363.69	53,178.25
Average per month last year.....	21,293.55	11,391.88	2,033.61	34,719.04

TABLE NO. 6.—*Value of work performed during fiscal year by Cristobal Dry Dock shops for individuals and companies.*

Month.	Other than Panama R. R.	Panama R. R.	Total.
1913.			
July.....	\$1,239.35	\$1,789.86	\$3,029.21
August.....	368.88	1,415.39	1,784.27
September.....	693.90	2,151.07	2,844.97
October.....	1,490.95	2,426.79	3,917.74
November.....	338.28	2,362.44	2,700.72
December.....	1,679.33	2,248.29	3,927.62
1914.			
January.....	1,243.40	2,416.83	3,660.23
February.....	4,928.36	2,223.63	7,151.99
March.....	5,232.11	1,702.73	6,934.84
April.....	3,163.78	1,557.02	4,720.80
May.....	527.09	2,235.53	2,762.62
June.....	207.66	3,369.35	3,577.01
Total.....	21,113.09	25,898.93	47,012.02
Average per month this year.....	1,759.42	2,158.24	3,917.66

TABLE NO. 7.—*Value of work performed monthly during fiscal year by Paraiso shops—Abstract of expenditures.*

Month.	Labor.	Material.	Services rendered by other divisions and departments.	Total.
1913.				
November.....	\$11,878.40	\$4,093.22	\$4,040.19	\$20,011.81
December.....	14,322.06	5,740.33	2,211.08	22,273.47
1914.				
January.....	17,323.63	3,882.77	2,699.42	23,905.82
February.....	13,741.24	6,278.85	372.97	20,393.06
March.....	16,443.95	8,713.38	2,687.80	27,845.13
April.....	16,607.75	7,204.99	2,855.60	26,668.34
May.....	19,094.17	9,065.75	6,666.96	34,826.88
June.....	22,796.51	19,648.68	6,402.12	48,847.31
Total.....	132,207.71	64,627.97	27,936.14	224,771.82
Average per month this year.....	16,525.96	8,078.50	3,492.02	28,096.48

TABLE NO. 8.—*Value of work performed during fiscal year by Paraiso shops for individuals and companies.*

Month.	Other than the Panama R. R.	Panama R. R. Co.	Total.
1913.			
November.....			
December.....	\$45.34		\$45.34
1914.			
January.....			
February.....			
March.....			
April.....	20.16		20.16
May.....	6.53		6.53
June.....			
Total.....	72.03		72.03
Average per month.....	9.00		9.00

TABLE NO. 9.—*Total overtime of mechanical division, exclusive of Paraiso shops and Cristobal Dry Dock shops, with the per cent of the total pay roll.*

Month.	Pay roll.	Overtime.	Per cent.
1913.			
July.....	\$207,296.54	\$7,900.96	3.8
August.....	209,321.01	15,035.78	7.2
September.....	199,672.39	10,545.47	5.3
October.....	206,238.97	10,987.09	5.2
November.....	195,871.60	12,550.40	6.4
December.....	207,635.36	11,115.13	5.3
1914.			
January.....	205,374.72	9,544.50	4.6
February.....	186,781.56	12,509.63	6.7
March.....	212,538.53	14,484.17	6.8
April.....	152,236.56	25,473.58	16.7
May.....	149,576.49	19,231.74	12.8
June.....	148,675.12	10,433.73	7.0
Average per month this year.....	190,101.57	13,317.68	7.0
Average per month last year.....	201,708.39	11,893.31	5.9

TABLE NO. 10.—*Total overtime of the Cristobal Dry Dock shops during fiscal year, with the per cent of the total pay roll.*

Month.	Pay roll.	Overtime.	Per cent.
1913.			
July.....	\$18,087.81	\$1,284.33	6.6
August.....	20,328.97	1,805.57	8.9
September.....	23,779.39	2,859.65	12.0
October.....	23,043.43	1,854.97	8.0
November.....	19,147.33	1,458.47	7.6
December.....	22,989.74	1,712.99	7.5
1914.			
January.....	26,391.42	2,293.69	8.7
February.....	31,131.92	2,122.46	6.8
March.....	41,456.12	7,984.19	19.3
April.....	35,097.17	7,694.38	21.9
May.....	31,337.27	1,278.55	4.1
June.....	32,998.57	2,649.28	8.0
Average per month this year.....	27,149.10	2,916.54	10.7
Average per month last year.....	22,739.20	1,172.77	5.2

TABLE NO. 11.—*Total overtime of the Paraiso shops during fiscal year, with the per cent of the total pay roll.*

Month.	Pay roll.	Overtime.	Per cent.
1913.			
November.....	\$11,878.40	\$3,480.89	29.3
December.....	14,322.06	2,727.08	19.0
1914.			
January.....	17,323.63	2,800.08	16.1
February.....	13,741.24	2,752.62	20.0
March.....	16,443.95	2,267.95	13.8
April.....	16,607.75	2,826.61	17.0
May.....	19,094.17	3,587.08	18.8
June.....	22,796.51	4,187.89	18.4
Average per month this year.....	16,525.96	3,078.78	18.6

TABLE NO. 12.—*Actual shop expense percentage of the mechanical division (exclusive of Cristobal Dry Dock shops and Paraiso shops), dry-dock shops, and Paraiso shops.*

Month.	Mechanical division, exclusive of Cristobal Dry Dock shops and Paraiso shops.	Dry-dock shops.	Paraiso shops.
1913.			
July.....	47.75	52.74	.....
August.....	45.82	41.96	.....
September.....	55.98	48.47	.....
October.....	51.04	48.92	.....
November.....	45.06	43.80	45.00
December.....	44.08	43.69	44.96
1914.			
January.....	45.93	34.80	39.10
February.....	47.65	38.00	20.90
March.....	23.25	29.53	43.54
April.....	46.64	24.76	34.31
May.....	56.66	46.63	59.15
June.....	59.25	42.69	58.44
Average per month this year.....	47.43	35.59	50.13
Average per month last year.....	41.19	37.47	.....

TABLE NO. 13.—*Applied shop expense percentage of the mechanical division (exclusive of dry-dock shops and Paraiso shops), dry-dock shops, and Paraiso shops.*

Month.	Mechanical division, ex- clusive of Cristobal Dry Dock shops and Paraiso shops.	Dry-dock shops.	Paraiso shops.
1913.			
July.....	50.0	65.0	.....
August.....	50.0	65.0	.....
September.....	50.0	60.0	.....
October.....	50.0	50.0	.....
November.....	50.0	50.0	35.0
December.....	50.0	50.0	35.0
1914.			
January.....	50.0	50.0	35.0
February.....	50.0	50.0	35.0
March.....	50.0	50.0	35.0
April.....	Various.	50.0	35.0
May.....	Various.	30.0	35.0
June.....	Various.	50.0	45.0

TABLE NO. 14.—*Output and cost of brass castings during fiscal year.*

Month.	Output (pounds).	Total cost per pound.	Number of patterns made.	Number of castings made.
1913				
July.....	5,740	\$0.19699	24	641
August.....	7,897	.29226	42	793
September.....	7,893	.23830	53	2,717
October.....	14,625	.25479	21	1,576
November.....	19,534	.21970	31	2,557
December.....	19,652	.24510	42	2,981
1914				
January.....	14,475	.20656	39	1,355
February.....	11,888	.26244	55	3,366
March.....	21,956	.19360	32	1,895
April.....	15,973	.13800	69	881
Total for 10 months.....	139,633	.....	408	18,762
Average for 10 months.....	13,963	.22808	41	1,876
Average for 12 months last year.....	27,056	.20520	34	1,564
May.....	19,010	.12420	21	1,127
June.....	19,713	.14260	67	2,290
Total for 2 months.....	38,723	.....	88	3,417
Average for 2 months.....	19,362	.13359	44	1,709

NOTE.—Effective with May accounts the costs of coremaking and molding are charged directly to the shop order. The figures for May and June represent the cost of the castings exclusive of the labor cost of coremaking and molding.

TABLE NO. 15.—*Output and cost of iron castings during fiscal year.*

Month.	Output (pounds).	Total cost per pound.	Number of patterns made.	Number of castings made.
1913.				
July.....	380,856	\$0.035453	110	17,350
August.....	247,372	.032373	108	11,434
September.....	296,800	.039950	91	7,638
October.....	391,430	.042250	109	18,207
November.....	310,796	.038600	102	35,137
December.....	429,540	.038990	118	19,415
1914.				
January.....	398,484	.032910	156	6,101
February.....	452,772	.029300	100	7,480
March.....	277,269	.034130	144	5,358
April.....	305,723	.035000	152	8,092
Total for 10 months.....	3,491,042	.....	1,190	136,262
Average for 10 months.....	349,104	.036672	119	13,626
Average for 12 months last year.....	587,605	.028996	82	17,481
May.....	292,126	.041060	169	8,604
June.....	250,931	.049960	115	5,703
Total for 2 months.....	543,057	.....	284	14,307
Average for 2 months.....	271,529	.....	142	7,154

NOTE.—Effective with May accounts the costs of coremaking and molding are charged directly to the shop order. The figures for May and June represent the cost of the casting exclusive of the labor cost of coremaking and molding. The increased costs for the months of May and June are due to the decrease in output.

TABLE NO. 16.—*Output and cost of steel castings during fiscal year.*

Month.	Output (pounds).	Total cost per pound.	Number of patterns made.	Number of castings made.
1913.				
July.....	85,349	\$0.069930	18	7,701
August.....	20,807	.191918	10	2,056
September.....	33,719	.100760	74	551
October.....	50,070	.093860	21	208
November.....	70,722	.108900	12	411
December.....	82,837	.092110	19	597
1914.				
January.....	128,907	.075100	23	612
February.....	101,268	.076620	32	638
March.....	119,318	.079600	45	1,030
April.....	60,223	.072000	44	565
Total for 10 months.....	753,220	.....	298	14,369
Average for 10 months.....	75,322	.083288	30	1,437
Average for 12 months last year.....	66,216	.078485	28	1,863
May.....	131,569	.070120	21	1,183
June.....	89,599	.071080	39	470
Total for 2 months.....	221,168	.....	60	1,653
Average for 2 months.....	110,584	.070508	30	827

NOTE.—Effective with May accounts the costs of coremaking and molding are charged directly to the shop order. The figures for May and June represent the cost of the casting exclusive of the labor cost of coremaking and molding.

TABLE NO. 17.—*Number of repairs to locomotives during fiscal year.*

Month.	Running.	Heavy.	Total.
1913.			
July.....	3,308	14	3,322
August.....	3,291	6	3,300
September.....	1,931	9	1,940
October.....	1,564	2	1,566
November.....	1,581	2	1,583
December.....	1,717	7	1,724
1914.			
January.....	1,507	4	1,511
February.....	1,463	6	1,469
March.....	1,661	5	1,666
April.....	854	4	858
May.....	810	1	811
June.....	712	.....	712
Average per month this year.....	20,402	60	20,462
Average per month last year.....	1,700.2	5	1,705.2
	3,270.5	43	3,313.5

TABLE NO. 18.—*Repairs made during fiscal year to equipment other than locomotives and cars.*

Month.	Cranes.	Track shifters.	Unload-ers.	Spread-ers.	Narrow-gauge loco-motives.	Others.	Total.
1913.							
July.....	37	9	29	22	.....	.....	97
August.....	29	6	33	28	3	2	101
September.....	11	3	25	6	.....	4	49
October.....	8	6	25	21	.....	4	64
November.....	46	3	17	12	.....	15	93
December.....	37	16	13	20	.....	12	98
1914.							
January.....	51	9	9	11	.....	18	98
February.....	46	6	42	29	.....	14	137
March.....	22	.....	29	31	.....	7	89
April.....	13	.....	33	20	.....	2	68
May.....	21	.....	12	20	.....	3	56
June.....	6	.....	6	1	.....	4	17
Total.....	327	58	273	221	3	85	967
Average per month this year.....	27.25	4.83	22.75	18.42	.25	7.08	80.58
Average per month last year.....	16.84	6.00	35.25	31.58	8.58	14.58	112.83

TABLE NO. 19.—*Number of shop and field repairs made to different classes of cars during fiscal year.*

Equipment.	Number of shop repairs.	Number of field repairs.	Total.
Lidgerwood flat cars.....	3,595	50,172	53,767
Western dump cars.....	2,156	18,142	20,298
Oliver dump cars.....	2,024	23,030	25,054
Ingoldsby dump cars.....	1	.....	1
Steel flat cars.....	347	3,005	3,352
Labor cars.....	376	721	1,097
Miscellaneous cars.....	1,494	21,952	23,446
Total.....	9,993	117,022	127,015
Average per month this year.....	833	9,752	10,585
Average per month last year.....	1,885	16,648	18,533

TABLE NO. 20.—*Statement of hostling cost, fiscal year 1913-14.*

Month.	Hos- tlings.	Direct labor.	Material.	O. D.	Sur- charge.	Tota. cost.	Average cost direct labor per hostling.	Average total cost per hostling.
1913.								
July.....	7,616	\$6,220.10	\$660.28	\$920.89	\$3,110.05	\$10,911.32	\$0.8167	\$1.4327
August.....	7,819	5,146.41	527.55	1,448.66	2,573.21	9,695.83	.6582	1.2400
September.....	5,725	4,079.00	553.35	1,024.02	2,039.50	7,695.87	.7125	1.3443
October.....	4,789	2,849.12	36.47	904.07	1,424.56	5,214.22	.5949	1.0888
November.....	4,215	2,769.61	416.67	251.89	1,384.81	4,822.98	.6571	1.1442
December.....	4,419	2,221.27	195.55	177.08	1,110.64	3,704.54	.5027	.8383
1914.								
January.....	4,042	2,008.23	336.00	172.23	1,004.12	3,520.58	.4968	.8710
February.....	3,588	1,980.32	172.96	295.45	990.16	3,438.89	.5519	.9584
March.....	3,836	1,866.01	269.02	144.88	933.01	3,212.92	.4864	.8376
April.....	2,747	1,737.77	25.39	3.00	853.77	2,619.93	.6326	.9537
May.....	5,525	3,115.51	242.88	95.84	1,454.44	4,608.67	.5639	.8884
June.....	5,799	3,513.45	348.93	.....	2,157.59	6,019.97	.6059	1.0381
Total.....	60,120	37,506.80	3,785.05	5,438.01	19,035.86	65,765.72	.6239	1.0939
Average per month this year.....	5,010	3,125.56	315.42	453.17	1,586.32	5,480.47	.6239	1.0939
Average per month last year.....	7,448	5,741.86	804.32	925.15	2,440.93	9,912.25	.7709	1.3309

APPENDIX E.

REPORT OF THE SUPERINTENDENT OF TRANSPORTATION, DEPARTMENT OF OPERATION AND MAINTENANCE.

ANCON, CANAL ZONE, *July 20, 1914.*

SIR: I have the honor to submit the following report of operations in the division of canal transportation during the fiscal year ended June 30, 1914.

DIVISION ORGANIZATION.

Under the Governor's circular No. 660-1 of April 1, 1914, the division of canal transportation was ordered as a division of the department of operation and maintenance. Under the supervision of the superintendent of transportation, reporting to the Governor, it is charged with the safe conduct of vessels through The Panama Canal, except at the locks, the port captains, the board of local inspectors, the pilots, the care and operation of lights and beacons when completed, the inspection and admeasuring of vessels.

Under the provisions of circular No. 661, of April 1, 1914, Capt. Hugh Rodman, United States Navy, was appointed superintendent of canal transportation, with headquarters temporarily at Ancon.

During the month of April no active operations, other than those incident to the board of local inspectors, were carried on. The superintendent prepared and submitted to the Governor a tentative outline for the rules and regulations for the navigation of The Panama Canal and approaches thereto, which is now in course of publication; also a revision of the rules and regulations governing the steamboat-inspection service and the board of local inspectors, which have been published at this time.

CAPTAINS OF THE PORTS.

On May 5, as provided in circular No. 661-8, the offices of the captains of the ports at Cristobal and Balboa were established; Commander Douglass E. Dismukes, United States Navy, being appointed as captain of the port at Cristobal, and Lieut Commander Henry V. Butler, United States Navy, as captain of the port at Balboa. The respective offices assumed charge of the assignment of wharves, docking and berthing of vessels, furnishing of pilot service to shipping, the admeasurement of vessels for transit through the canal, and the general supervision and enforcement of canal and harbor regulations relating to shipping.

Pilots have been employed as follows:

By transfer from the dredging division.....	5
By transfer from the Panama R. R.....	2
Employed in the United States.....	1
Total.....	8

The pilots are stationed four each in the offices of the captains of the ports. In addition, requisition was made on the Washington office for the employment of one more pilot. The services of the pilots

have been utilized in piloting vessels in and out of the terminal ports, in connection with the lightering of cargo through the canal, and in learning the aids to navigation, etc., in connection with piloting vessels through the canal.

Floating equipment was transferred to this division as follows:

Tugs, from the dredging division.....	2
Launches, from the Panama R. R.....	1
Launches, from the lighthouse division.....	2

The two tugs and the pilot boat are under the supervision of the captain of the port, Cristobal; the other two launches are in use in connection with the lighthouse service.

Recommendations were made and approved, and plans perfected for pooling the launches of the respective division at Cristobal under the jurisdiction of the captain of the port, and directions to this effect were issued, effective July 1, 1914.

On May 18 the project of lightering cargo through the canal was begun; 12 lighters were diverted to this service and regular traffic operations developed. The tug *Mariner* is employed in this work.

BOARD OF LOCAL INSPECTORS.

The board held its regular meetings throughout the year and performed the various duties assigned to them. Their annual report is inclosed herewith and forms a part of this report.

LIGHTHOUSE SERVICE.

On June 16 the division of lighthouses was taken over by the division of canal transportation, and plans perfected for the maintenance and operation of this service. The annual report of this work has been prepared by the engineer of maintenance, under whose supervision the construction work was performed.

BOARD OF ADMEASUREMENT.

The board of admeasurers was designated by circular No. 661-4, as follows: Capt. Hugh Rodman, United States Navy, chairman; Commander D. E. Dismukes, United States Navy, member; Lieut. Commander Henry V. Butler, United States Navy, member.

Two measurers have been appointed and stationed one each at the terminal ports. The board met at intervals, upon call of the chairman, and discussed the interpretation of the Rules for the Measurement of Vessels for The Panama Canal, giving decisions in several cases upon requests from shipping, through the Governor.

The following vessels have been measured: Launches *Coco Solo* and *Aloha*, for passage through the canal, no certificates being issued. Steamers *Santa Clara* of W. R. Grace & Co., *Salvador* of the Salvadorean Railway Co., *Limari* of the Compania Sud America de Vapores.

The total number of gold employees in the division as of June 30 was 24.

Respectfully,

HUGH RODMAN,
Superintendent of Transportation.

Col. GEO. W. GOETHALS, United States Army,
Governor Panama Canal, Culebra, Canal Zone.

APPENDIX TO APPENDIX E.

ANCON, CANAL ZONE, *July 1, 1914.*

SIR: I have the honor to submit herewith report of the operations of the board of local inspectors for the fiscal year ended June 30, 1914, as required by section No. 13 of the rules and regulations governing the board, revised as of May 1, 1914, and published in Governor's circular No. 644.

ORGANIZATION AND PERSONNEL.

The organization of the board remains the same as during the previous fiscal year, consisting of three inspectors who devote part time to the work without additional compensation, one deputy inspector of hulls and boilers, devoting his entire time to the work, and one clerk on part time, are also engaged in this service.

Changes in the personnel were made during the year as follows: Mr. L. A. Helliksen appointed as a member of the board, effective November 19, 1913, vice Mr. Charles J. Anderson, resigned; Capt. Hugh Rodman, United States Navy, appointed as chairman, effective January 23, 1914, vice Lieut. Col. W. V. Judson, on leave; a new board under the permanent organization appointed, effective April 9, 1914, consisting of Commander D. E. Dismukes, United States Navy, chairman; Lieut. Commander H. V. Butler, United States Navy, member; Mr. James Macfarlane, of the dredging division, member.

NAVIGATION LAWS, ETC.

Under date of May 1, 1914, revised rules and regulations in relation to the board of local inspectors, The Panama Canal, including the inspection of steam and other vessels, and matters relating to the issuance of licenses for officers of vessels, and others, were published under the Governor's circular No. 644.

ACCIDENTS AND INVESTIGATIONS.

The following marine accidents of a serious nature occurred during the period covered by this report:

On July 10, 1913, the tug *Porto Bello* collided with the dredge *Sandpiper*, causing damage estimated at \$750. The cause of this collision was due to an error in judgment on the part of the master of the *Porto Bello*, and as his death occurred four days thereafter, no investigation was held.

On July 26, 1913, the launch *Manzanillo*, engaged in survey work in Gatun Lake near Frijoles, caught fire and was totally destroyed. The operator of the launch, Esau Johnson, was drowned while attempting to swim to near-by trees.

On August 3, 1913, *Clapet No. 6* rammed the steamer *Aysen* while going alongside to pick up a lighter lying at the stern of the steamer. An investigation by the board showed that the mate in charge of the *Clapet* at the time of the accident was primarily responsible, and after a trial, conducted in accordance with the rules and regulations of the board, his license as mate of self-propelling barges was revoked.

On October 22, 1913, the board reported regarding damage occurring at New Gorgona to Panama Railroad barges *Nos. 1, 7, 8, 9, 10*, used in transporting building material to that point, and recommended that repairs to the extent of \$12,000 be made.

On November 20, 1913, a collision occurred between *Clapet No. 2* and a rowboat in Culebra Cut near Bas Obispo, resulting in the drowning of one of the occupants of the rowboat. Upon investigation the board decided that the accident was due to the confused state of mind of the man in charge of the rowboat, and to his failure before attempting to cross the canal to await the passage of *Clapet No. 2*, which had sounded her whistle when approaching a bend which had for a time concealed her from view. The remedial measure was suggested that the masters of all dredges and other floating plant be directed to instruct all boats' crews to keep out of the way of large craft, which is the only practicable way to avoid trouble.

On the night of November 22, 1913, a gasoline explosion occurred on board the launch *San Blas*. Investigation was made by the board, who reported in substance as follows: That the explosion was probably caused by the use of a lighted lantern during the process of filling the tank of the launch with gasoline, and recommended that the night general foreman, Mr. W. D. McHenry, be warned to exercise greater care in the future when handling this highly inflammable fuel.

On the morning of December 28, 1913, the steamship *Huallaga*, of the Peruvian Steamship Co., while docking at Balboa Wharf, touched the bow of the steamship *Chile*, of the Pacific Steam Navigation Co. No damage was done to the *Chile*, but the flagstaff and a small portion of the railing on the *Huallaga* were broken. Investigation was made by the board, and after consideration it was decided that the responsibility could not be placed, inasmuch as it appeared that authority was divided between the pilot and the master of the tug handling the ship.

On the night of March 11, 1914, there occurred the explosion of an oil tank on board the dredge *Corozal*. The report of the investigation made by the board states that the explosion was probably due to the ignition of gas by a light of some kind in the hands of the colored employee who was handling the oil hose. The board was further of the opinion that the assistant engineer in charge of the dredge was negligent in his duty, and recommended that he be suspended for a period of 15 days.

STEAMBOAT INSPECTION.

The following table shows the number of vessels inspected and certificated by the board during the year:

Over 100 gross tons.....	17
From 15 to 100 gross tons.....	10
Less than 15 gross tons.....	81
Total.....	108

This number shows an increase of 14 inspections over the number made during the year 1913.

The collector reports receipts from this source amounting to \$3,426.09, an increase of \$687.54, over the preceding year.

One certificate of inspection was refused—this to Mr. Leonard Butz for a canvas motor boat, on account of unseaworthiness.

Under the provision of circular No. 371 of January 28, 1911, the board made two general inspections of all floating equipment of the canal and the Panama Railroad Co., reports of these inspections being submitted to your office for such action as might be considered necessary for the proper upkeep and repair of this equipment. Marine equipment in need of general repairs was inspected by the board throughout the year, in accordance with paragraph No. 3 of circular No. 371.

On April 22, 1914, the board received the files from the mechanical division and assumed the duties of inspecting the boilers on the floating equipment of the canal and Panama Railroad Co., with the exception of the steamships of the latter company. To June 30, 1914, there were 28 inspections made and reports rendered to the divisions concerned.

During the year the board made appraisals of floating equipment for sale or transfer, as directed by the Governor or requested by the surveying officer.

LICENSES ISSUED.

A total of 163 licenses were issued to marine officers, as follows:

	Total.	Original.	Renewal.
Pilots.....	79	59	20
Masters.....	22	19	3
Mates.....	39	36	3
Engineers.....	23	23	.....
Total.....	163	137	26

The corresponding totals for the year 1913 were 29, 95, and 114, respectively, showing a decrease of 46 in the total number of licenses issued.

Attached hereto is a classified statement of officers licensed, which shows in detail the grade of the various licenses issued.

Sixty-seven applicants were examined for color blindness, as shown in the following table:

At Ancon Hospital.....	51
At Colon Hospital.....	15
At Culebra Dispensary.....	1
Total.....	67

The number examined during the year 1913 was 128, showing a decrease of 61 for the year 1914.

CHAUFFEURS.

A total of 149 chauffeurs' licenses were issued during the year. Of this number 135 were original licenses, 13 were duplicates issued on account of loss of original badge, and 1 license as operator of automobile fire engine. The total number issued during 1913 was 120, showing an increase of 29 in the year 1914.

NAVIGATORS OF MOTOR BOATS.

There were issued 121 licenses to navigators of motor boats. Of these 117 were for boats of less than 15 gross tons, 1 for 20 tons, 1 for 25 tons, 1 for 50 tons, and 1 unlimited.

LICENSES REVOKED.

Demetrio Tacus, mate of self-propelling barges, license No. 88-2, August 18, 1913, for carelessness in handling *Clapet No. 6* on the night of August 3, whereby the steamer *Aysen*, of the *Compania Sud America de Vapores*, was damaged to the extent of \$500 to \$750.

William Doerwell, chauffeur, license No. 289, March 23, 1914, for obtaining a license under false name.

LICENSES REFUSED.

	For failure to pass examination.	For failure to present credentials.
Marine licenses.....	12	3
Navigators of motor.....	4	.....
Chauffeurs.....	47	.....
Operator of fire engines.....	2	.....
Total licenses refused	65	3

Respectfully,

D. E. DISMUKES,
Chairman of the Board.

Col. GEO. W. GOETHALS, United States Army,
Governor of the Panama Canal, Balboa Heights, Canal Zone
(Through the Superintendent of Canal Transportation).

EXHIBIT 1.

Detailed statement of officers' licenses issued by the board of local inspectors during the fiscal year of 1914:

Masters of gas launches.....	1
Masters of steam launches.....	2
Masters of ladder dredges.....	7
Masters of suction dredges.....	4
Masters of dipper dredges.....	8
Chief and second engineers of self-propelling barges.....	1
Chief and second engineers of towboats.....	4
Chief, second, and third engineers on sea-going dredges and all engineers on ladder, dipper, and suction dredges.....	12
Chief, second, third, and fourth engineers on ships of any tonnage.....	6
Mates of towboats not exceeding 1,000 tons.....	1
Mates of dredges of all kinds.....	38
Pilots of towboats.....	4
Pilots of passenger and cargo steamers, any tonnage.....	43
Pilots, Gatun Lake, 3,000 tons.....	4
Pilots, Gatun Lake, 1,000 tons.....	28

Total licenses issued..... 163

D. E. DISMUKES, *Chairman of the Board.*

EXHIBIT 2.

Statement of inspections made by the board during the fiscal year 1914 and the revenues received therefrom (amounts furnished by the collector):

Month.	Inspec- tions.	Amount.	Month.	Inspec- tions.	Amount.
1913.			1914.		
July.....	6	\$162.35	January.....	9	\$45.00
August.....	8	461.55	February.....	9	577.45
September.....	6	89.45	March.....	10	694.09
October.....	1	5.00	April.....	9	418.20
November.....	5	25.00	May.....	6	282.75
December.....	3	15.00	June.....	6	650.25
			Total.....	.....	3,426.09

D. E. DISMUKES, *Chairman of the Board.*

APPENDIX F.

REPORT OF THE CHIEF QUARTERMASTER IN CHARGE OF THE SUPPLY DEPARTMENT.

CULEBRA, CANAL ZONE, *July 1, 1914.*

SIR: I submit the following report of the operations of the supply department for the fiscal year ending June 30, 1914.

The administration of the department has been difficult during the past year. The changes in the class and location of the work and the sweeping changes in the organization of the canal involving constant transfers of personnel, have materially increased the work of this department. To meet these changes, it has been necessary to transfer thousands of employees and millions of dollars' worth of material. The transfer of the employees has necessitated the demolition and removal of a number of the older settlements and the creation of new towns; this, in turn, has involved a radical adjustment of the districts, of the delivery service and a complete shift of the personnel of the department. The transfer of storehouses has involved the loading, checking and rehandling of hundreds of carloads and of thousands of tons of material, the value of which has run into the millions. The work of the department has never been conducted under more trying conditions and while ultimately the changes made will result in increased economy and efficiency for the permanent organization, the period of transition has been a difficult one. The various transfers and consolidations have greatly increased the scope of the former quartermaster's department. The force employed is larger than at any previous period due to the permanent building operations. The building force is from its nature a temporary one and the work of that division should be completed during the coming fiscal year.

Many of the changes have been so comparatively recent that the organization is incomplete but it is anticipated that within a very short period the supply department will be a closely knit organization which will handle material and supplies of all kinds for the canal organization.

The operations of the department are discussed in detail below.

ORGANIZATION.

The operation of the Balboa agency of the Panama Railroad was transferred back to the railroad company on July 16, 1913.

The assignment and care of Panama Railroad quarters and the maintenance and construction of Panama Railroad buildings was taken over by this department August 1, 1913.

The permanent building division was attached to this department on August 1, 1913.

The medical storehouse of the health department was transferred to this department April 1, 1914.

The repair work of the health department was taken over on April 15, 1914.

Under the provisions of the Panama Canal act the quartermaster and subsistence departments and the Panama Railroad commissaries were consolidated into what is now known as the supply department on April 1, 1914.

Beside the changes noted above, there were a number of minor changes such as the transfer of cement storehouses, of the service magazines, and a number of the field storehouses formerly under the jurisdiction of the construction divisions. The property work of some of the divisions was transferred to this department, although the auditing of property returns was transferred to the auditor under date of January 1, 1914.

PERSONNEL.

Changes have occurred as follows:

Mr. Frank Holmes appointed resident engineer August 1, 1913.

Mr. C. B. Cook appointed assistant to the resident engineer December 5, 1913.

Mr. J. B. Fields appointed general foreman in charge of erection of buildings, December 5, 1913.

Mr. M. J. Schiavoni resigned as architect December 3, 1913.

Mr. S. M. Hitt appointed architect January 1, 1914.

Mr. H. P. Oram appointed superintendent, northern division, permanent buildings division, February 18, 1914.

Mr. Frank J. Carew appointed superintendent, southern division, permanent buildings division, August 19, 1913.

Capt. C. Nixon, depot quartermaster, relieved from duty with the commission on January 2, 1914.

Mr. C. H. Mann appointed depot quartermaster December 2, 1913.

Mr. R. K. Morris appointed storekeeper, Balboa, May 1, 1914.

Capt. F. O. Whitlock appointed assistant chief quartermaster April 1, 1914.

Mr. B. L. Jacobson appointed depot commissary May 1, 1914.

Maj. W. R. Grove appointed special inspector May 29, 1914.

Mr. B. C. Poole transferred from district quartermaster, Ancon, to district quartermaster, Cristobal, January 1, 1914.

Mr. R. R. Watson transferred from district quartermaster, Cristobal, to district quartermaster, Ancon, January 1, 1914.

Mr. R. M. Gamble, district quartermaster, Gatun, relieved October 1, 1913.

Mr. J. T. Smith transferred from district quartermaster, Pedro Miguel, to district quartermaster, Gatun, September 1, 1913.

Mr. Harry Dundas transferred from district quartermaster, Las Cascadas, to district quartermaster at Paraiso, October 12, 1913.

Mr. R. C. Shady, district quartermaster, Corozal, was transferred to the division of municipal engineering April 1, 1914.

Mr. J. H. K. Humphrey transferred from district quartermaster at Empire to district quartermaster, Corozal, April 1, 1914.

Mr. C. D. Morgan, district quartermaster, Porto Bello, resigned October 20, 1913.

LABOR.

The force employed has dropped steadily throughout the year, the force on June 30, 1914, being 29,673 as compared with 43,350 at the close of the previous fiscal year. The present force represents a

decrease of 15,030 men from the high mark of 44,733 men reached on March 26, 1913, and is lower than at any time since December, 1907. Accompanying the decrease in force there has been a large emigration from the Isthmus. For the first time since work on the canal was started there was an excess of departures over arrivals, the quarantine reports showing a net decrease of 14,822 for the year.

There has been neither a shortage nor a surplus of labor throughout the year.

During the year free transportation was given to 1,361 Americans, 1,173 West Indians, and 1,615 Europeans; the total cost of such free transportation was \$121,765.80. This figure was less than the estimated requirements for the fiscal year. This was due almost entirely to the fact that very few of the West Indian contract laborers have chosen to take advantage of the privilege of repatriation allowed under their contracts. But 707 West Indians were repatriated during the year, a very small number in comparison with the thousands that have been let out on account of reduction of force and that have left the Isthmus. Apparently these West Indians, who have been accustomed to the high wages and higher standard of living prevalent on the Canal Zone, have not chosen to return to their homes in the islands, but have chosen to seek employment on construction work in other fields. The United Fruit Co. for several months had a special agent on the Isthmus recruiting laborers released by the commission. Over 2,000 were sent to Honduras and thousands of others have gone to Costa Rica and Bocas del Toro. If it had not been for a large decrease in the gold force and the fact that free transportation was given to the Spaniards, to which they were not entitled under the terms of the contract, the transportation expense would have been relatively small.

The character of the force has radically changed during the past year. Dry excavation has been practically completed and the force of steam-shovel and transportation men greatly reduced. There has been a large increase in the building force and some increase in the dredging force.

All things considered, the reduction of force has worked out to date with very little friction and hardship as far as unskilled labor has been concerned.

QUARTERS.

The handling of quarters has been more difficult than at any other period since the inception of the canal work.

The shop forces have made two transfers, first from Gorgona to Empire and then from Empire to Balboa. The dredging men have been shifted from the two terminal points of Balboa and Cristobal to Paraiso. The transportation men were transferred from Las Cascadas and Empire to Balboa. The Porto Bello quarry was abandoned and the employees there scattered and transferred to points all over the Isthmus. Work at Toro Point was almost completed and the force, with the exception of the unskilled labor, withdrawn from that point.

The Gorgona settlement was wiped out of existence, Bas Obispo was abandoned, and Las Cascadas settlement turned over to the Tenth Infantry. The process of vacating the Empire-Culebra settlement was begun during the closing months of the fiscal year.

Besides the actual changes in the location of the work the many changes in organization have led to very frequent transfers of employees from one district to another and consequent changes of residence. The result has been that there has been a continual transfer of gold families and bachelors and of silver employees. This has materially added to the work of our district quartermasters. It speaks to their credit as well as to the common sense and fairness of the great majority of our employees that there have been relatively very few complaints, for these moves have in many cases resulted in considerable inconvenience and discomfort to the employees.

Economies were effected in the consolidation of districts, there being but six districts at the close of the fiscal year as compared with nine at the close of the previous fiscal year.

Districts were abolished as follows: Gorgona, September 1, 1913; Las Cascadas, October 1, 1913; Porto Bello, May 13, 1914.

A general shift of the district quartermasters was made in the early part of the fiscal year and the change increased the efficiency of the organization.

The only way in which we have been able to cope with the quarters situation has been by the transfer of buildings as well as employees. This work has been carried on on a very large scale.

At the end of the fiscal year we had a total of 17,938 men, women, and children in canal quarters as compared to 23,184 men, women, and children at the end of the previous fiscal year. The greatest percentage of decrease was among the American and European employees. We have approximately 300 less American families in quarters than a year ago. Practically all of the European families have gone, but there has been an increase in the number of West Indian families, due to the building of the La Boca settlement. We have been, and will be, barely able to take care of all the gold bachelors employed on the Pacific end in the settlements of Ancon, Balboa, and Corozal. Due to the curtailment of the building program caused by lack of funds, we will just about be able to take care of all American families that will have to be transferred from Culebra and Empire to the Pacific end. We have long waiting lists of applicants for married quarters, but it will be impossible to make any assignments until the force is still further reduced. As soon, however, as the building operations are completed and the force at the Balboa terminals reduced, the quarters situation will ease up, but in the meantime, the demand for married quarters will greatly exceed the supply.

Under authority conferred by you a silver town site was created at La Boca and provision made for accommodating the married and bachelor silver employees who would be on the permanent force. Houses which, through necessities of the work, had to be abandoned or moved were transferred and reerected at La Boca and converted into family quarters for silver employees. These apartments were rented out. The experiment has been a great success and has accomplished three good results: First, it has afforded the families of silver employees comfortable homes at a rental of fully 50 per cent less than what they would have to pay in the City of Panama; second, it has enabled the canal to use to good advantage buildings which would otherwise have had to be abandoned or sold for little or nothing; third, it has enabled the canal to derive a reasonable return from the investment.

Besides the settlement at La Boca the existing quarters for married employees on the silver roll at Paraiso and Cristobal were thoroughly overhauled and repaired. After the buildings had been repaired and painted a rental was charged. Practically no repairs had been put on these buildings for a number of years. They were dilapidated and in such condition as to expose the canal to criticism. A number of laborers' barracks at Gatun were converted into silver married quarters and a rental charged. At the close of the fiscal year 153 houses, with 736 apartments and rooms, were rented to employees on the silver roll, the monthly rental being \$3,736.

In spite of the various conditions which increased the cost of the operation of the quarters, to wit, the many moves and transfers, the expense of handling and caring for quarters has materially decreased during the year, the proportionate decrease in expense being greater than the decrease in the number of employees.

ZONE SANITATION.

The system of requests put into effect during the previous fiscal year has worked out in a very satisfactory manner. There has been no friction between the sanitary inspectors and the district quarter-masters. On account of the elimination of some of the settlements the amount of grass cutting has been materially reduced, the total amount cut being 4,077 acres, as compared with 7,356 acres for the previous fiscal year. There was an increase in the proportion of grass cut by horse mower which correspondingly decreased the total unit costs. The unit cost of grass cut by scythe was reduced from \$9.05 to \$8.78 per acre and grass cut by mower from \$1.77 to \$1.53 per acre. The unit cost of all grass cut was \$6.15 per acre.

Comparison of the cost of sanitary work done by this department during the past five years is given below. The costs have been cut in half since 1912.

	1910	1911	1912	1913	1914
Sanitation proper.....	\$233,693.00	\$210,403.29	\$180,675.67	\$125,983.21	\$84,594.34
Hospitals, quarantine, etc.....	97,139.81	77,284.48	71,092.40	63,700.96	50,521.62
Total.....	330,832.81	287,687.77	251,768.07	189,684.17	135,115.96

CORRALS.

The number of animals in canal corrals was exactly the same as at the close of the previous fiscal year. The proportion of public and private animals has materially changed, there being an increase of 36 in the number of public animals and a corresponding decrease of 36 in the number of private animals.

The demand for wagon transportation has been greater than at any time since 1904, and the supply has been entirely inadequate. It was necessary to purchase 100 new mules in addition to the 50 which were purchased at the close of the previous fiscal year. The town-site work, including a large amount of grading and road work; the building work, including a large amount of hauling of material for new buildings; and the transfer of the collection of garbage in

the city of Panama from the Panaman Government to the health department has created this heavy demand for teams. Sixty teams daily have been turned out to the division of municipal engineering alone. There have also been a number of isolated jobs which have called for team service, such as the construction of the transmission line.

On account of the inadequate supply of mules, all public animals have been worked to the limit, and a sufficient reserve has not been kept. The losses, while not heavy, were considerably greater than last year. Nine horses and 41 mules died or were destroyed during the year, as compared with 11 horses and 24 mules during the previous fiscal year. All mules with the exception of the 150 purchased during the last 15 months have averaged over 7 years' service on the Isthmus.

The table below shows losses from disease, accident, condemnation, and sale since inception of the work.

	Horses.	Mules.
Animals purchased since inception.....	160	746
Animals condemned and sold since inception.....	27	71
Animals died and destroyed since inception.....	58	232
Animals in corrals on June 30, 1914.....	75	443

BUILDING CONSTRUCTION.

On June 30, 1914, there were 2,535 buildings in canal settlements, of which 117 belonged to the Panama Railroad, 19 to the Navy, Army, and Marine Corps, leaving 2,399 belonging to The Panama Canal. Of this number, 567 were French buildings remaining of the total of 2,148 French buildings turned over by the French Company in 1904. During the year 136 buildings were demolished; 107 were sold, realizing \$7,453.76. Practically all of the buildings demolished and sold were old French buildings. The raising of the lake necessitated the removal, demolition, and sale of all buildings at Gorgona and Matachin and most of the buildings in the labor camps at Chagres and Miraflores. Slides caused the demolition and removal of some of the buildings at Culebra, and construction work necessitated the removal of all buildings on Diablo Hill.

The distribution of the buildings belonging to the canal has been entirely altered, due to the demolition and sales above referred to and the removal of American buildings to other points. Of the 189 buildings at Gorgona, not one is left. Of the 57 buildings at Miraflores, but 7 are left. There was a decrease of 30 buildings at Bas Obispo, 33 at Culebra, 38 at Empire, 53 at Gatun, 22 at Cristobal, 29 at Pedro Miguel, and an increase of 49 at Ancon, 11 at Corozal, and 183 at Balboa.

In general, it has been our policy to sell all old French buildings that had to be abandoned; to move all American buildings that were in good condition and of such a type that they could be readily reerected; and to demolish all old French buildings that could not be sold and all American buildings that could not be utilized, and either sell or use the lumber, roofing, hardware and plumbing fittings recovered.

It is doubtful whether house wrecking and reerection has ever been conducted on such a large scale. During the year 15 to 18 gangs, with an average strength of approximately 700 men, have been engaged on this work. The former traveling gangs had already had much experience in this line and a number of new gangs have been trained to the work. It has been handled more swiftly and more economically than ever before.

One hundred and-seventy-five buildings were taken down, of which 153 have been reerectioned, and 22 were in course of erection on June 30, 1914. Total cost of this work has been \$308,310.63. The work of removal has been divided into four distinct periods.

During the months of July and August, 1913, the traveling gangs completed the removal and reconstruction of buildings from Gorgona and Matachin at Corozal and the demolition of those buildings that could not be used to advantage. The gangs were working against time, as the work had to be completed by September 1. Beside the work originally planned, the gangs had to demolish most of the native houses, the native owners having declined to do this work; had to tear down the buildings at the Gorgona shops; and to take down a lot of buildings purchased by the Panaman Government.

During the months of August, September and October, 1913, gangs handled the removal and reerection of buildings at Pedro Miguel and Miraflores. Nine type 14 buildings had to be raised at Pedro Miguel from 6 feet to 16 feet. A number of type 17 cottages had to be moved to new locations and the buildings on the west side of the railroad torn down or moved out of the way.

During the period November 1, 1913 to May 1, 1914, practically the entire force was engaged in the construction of the town at La Boca for silver married employees. Fifty-two buildings, accommodating 413 families, were moved and reerectioned at La Boca, at a cost of \$110,045.50, or an average cost per apartment of \$266. The original estimated cost was \$300 per apartment, or \$120,000 for 400 apartments. The houses were subdivided according to their type, and an effort made to grade them according to the needs of the silver employees. The cost varied from \$111 to \$520 per apartment, and the rental ranges from \$3 to \$9 per month. Beside the work for silver married employees at La Boca an entire new encampment was constructed for bachelors at a cost of \$30,380.51. This work, however, was not entirely completed at the close of the fiscal year. The range closets, cook sheds, washhouses, and bathhouses for the bachelor and married employees at La Boca cost \$15,511.14.

The buildings at La Boca were drawn from all over the Isthmus, those buildings being used which either had to be moved or were surplus on account of reduction of the force in the district from which they were taken. Of the 52 buildings removed, 4 came from Gorgona, 2 from Bas Obispo, 7 from Las Cascadas, 5 from Diablo, 17 from Empire, 7 from Culebra, 3 from Porto Bello, 2 from Gatun, 1 from Pedro Miguel, and 4 from Ancon Hospital. A number of married quarters were moved and reerectioned at Corozal during July and August, 1913, although most of the buildings erected at Corozal were begun during the previous fiscal year. While a few gold married quarters were reerectioned at Ancon in the early part of 1914, the gangs were not transferred in force to this work until May 1. On

June 30, 45 buildings, accommodating 50 gold families, had been completed or were in course of reerection. Up to June 30 the cost of gold married quarters at Ancon amounted to \$77,783.34.

While experience has shown that buildings can be moved faster and more economically when no alterations are made in the type, it was considered, in view of the fact that the buildings being reerected at Ancon would be used for the permanent force, that it would be better to make some alterations. A number of modifications and improvements were made in the type 17, type 1, and type 4 houses which materially improved the buildings, although adding somewhat to the cost. However, the total cost when reerected was far below the original cost.

Besides the type buildings moved to Corozal and Ancon, the Young Men's Christian Association, telephone exchange, and commissary at Gorgona were moved to Pedro Miguel; the lodge hall, post office, and quartermaster's office from Gorgona to Balboa. The cement shed at Miraflores was taken down in two parts. One portion was reerected at Corozal and the other portion at Balboa. The European laborers' mess hall at Miraflores was moved to La Boca and reerected as a commissary. The commissary at Pedro Miguel was reerected at La Boca as silver married quarters.

The condition of the buildings moved was found in general to be surprisingly good. With proper maintenance, there is no reason why the reerected buildings should not have a life of at least 20 years.

The removal and reerection of these buildings has helped materially in the quarters problem. On account of the delay in construction of permanent quarters, we would have had difficulty in taking care of any of the transfers that were made.

Very few new frame structures were put up during the fiscal year. Altogether 22 buildings were constructed at a cost of \$31,124.26.

One gang, under Foreman Galliher, has been handling the work at the Darien radio station for the Navy throughout the year. Originally 3 buildings, at a cost of \$20,000, were to be constructed by this department for the Navy Department. The supply department has constructed, beside these buildings, the foundations for the towers, removed and reerected houses for the officer in charge, for the chief electrician, and has done various other jobs. The total cost of this work to June 30, 1914, has been \$53,314.72.

Due to the press of construction work it was impossible to give the same careful supervision to repair work as has been done in the past. It has been the policy to make extensive repairs and keep in good shape the American frame buildings in the present settlements of Ancon, Balboa, Pedro Miguel, Gatun, and Cristobal. We have kept repairs up at Corozal and at Paraiso but have made just as few repairs as possible at Empire, Culebra, and Porto Bello.

Some time ago it was anticipated that the building investment of the commission would be a dead loss at the completion of the canal. This has not been the case. Practically every American building ever put up by the commission has been put to good use and will be in use after the canal is finished. The buildings that have not been removed and reerected in the permanent settlements will, probably, be used and occupied by the Army. Buildings put up in permanent settlements should, as stated above, have a life of at least 20 years after the completion of the canal.

The permanent building division was attached to this department on August 1, 1913. The schedule of new construction, as far as regards quarters, has been laid out by the chief quartermaster. The original program called for the construction of 30 four-family and 30 two-family quarters, or a total of 180 apartments. On account of the cost of the town-site work at La Boca, Balboa, and Pedro Miguel it was necessary to cut down this program. But 28 four-family and 9 two-family houses are in course of construction. These houses should be completed by November 1, 1914. Work on the 4 sub-station buildings, the hydroelectric station, and the administration building has retarded progress on quarters.

The detail of the permanent building construction is shown in appended report of Mr. Holmes.

MATERIAL AND SUPPLIES.

RECEIPTS.

The policy of the previous year was continued, viz, of limiting stocks as far as possible. This necessitated the placing of frequent orders for small amounts of material. While this policy was necessary in view of the closing down of certain portions of the work and the prospective close of operations on other parts of the work, it added to the difficulties of the storekeeping branch of the department and to the difficulties of the purchasing office in Washington. A total of 1,403 requisitions were prepared and forwarded to the general purchasing officer as compared with 1,258 during the previous fiscal year. There was a large increase in the number of cable orders placed.

The value of material received during the fiscal year was \$11,116,395.10, as compared with \$13,980,071.81 for the previous fiscal year; the local purchases amounted to \$2,293,144.66, as compared with \$2,733,867.51 for the fiscal year 1913. Local purchases of coal dropped from \$1,492,322.52 to \$929,176.57, and the local purchases of oil dropped from \$995,408.92 to \$863,206.66. Local purchases of tools were made from the McClintic-Marshall Construction Co. amounting to \$40,000.

The tonnage of the material received was considerably less than for the previous fiscal year. Two hundred and ninety thousand tons were received, as compared with 450,000 tons for the fiscal year 1913. These figures include piling.

The greater part of the decrease in tonnage is due to the cement, there being a decrease of 130,000 tons in that commodity alone. There was also a decrease in the amount of dynamite, iron, and steel received. There was a very large increase in the amount of lumber. Approximately the same amount of piling was received as during the previous fiscal year.

On account of poor business conditions in the United States, prices were much lower than previously, there being a marked decrease in the unit prices of steel, lumber, and most of the staple commodities.

OPERATIONS OF STORES.

The operation of stores, like the operation of quarters, has been conducted under the most trying conditions, owing to the change in the location and the character of the work. As the work changed,

material had to be shifted. Facilities at the Pacific end have been entirely inadequate to take care of the business, and under the circumstances good storekeeping was almost impossible.

An important change was made in the system of accountability for material carried in the storehouses. In former years material in storehouses has been accounted for under a system of physical accountability. This system was objectionable in that it involved duplication of work, viz, the keeping of a record of the material on stock cards and property returns, and in that it gave the storekeeper or the head of the department no idea of the value of the stock carried, either by classes or as a whole, except when inventories were taken at the close of the fiscal year. With the cooperation of the auditor, the system of physical accountability was eliminated, and a system of financial responsibility put into effect on January 1, 1914, covered by your Circular No. 520. The material is accounted for financially by classes, and the classification adopted was based on the Railway Storekeepers' Association's classification of material modified to meet local conditions. Monthly reports showing the values of receipts, issues, and stock on hand are made up for each of the storehouses. By this system the storekeepers and the chief quartermaster are enabled to watch the stock more closely and to avoid excessive accumulation of any class of stock.

Details of the operations of storehouses are given below.

The following storehouses were closed and the stock transferred during the fiscal year:

Gorgona storehouse, August 15, 1913.

Miraflores storehouse, November 1, 1913.

Pedro Miguel storehouse, September 15, 1913.

Toro Point storehouse, May 1, 1914.

Porto Bello storehouse, May 15, 1914.

Ancon storehouse, June 30, 1914.

The main store on the west side of the locks at Gatun was closed down December 31, 1913, and the stock transferred to Mount Hope and to the substore on the east side.

Cristobal shop store was closed and the car material transferred to Balboa.

As far as active operations were concerned, Empire storehouse was closed on April 1, 1914. On account of the congestion at Balboa and Mount Hope, the surplus stock was left at Empire until a more convenient time could be arranged to transfer the material.

Paraiso storehouse was opened December 1, 1913.

Various substores for the mechanical division and building branch of this department were established during the year.

Miraflores and Gatun cement sheds were closed. A portion of the Miraflores cement shed was taken down and reerected at Corozal and the storage of cement placed under the supply department. The storage capacity for cement on the Isthmus was reduced from 150,000 barrels to 30,000 barrels. This necessitated very close supervision to avoid overstocking and shortages. The cost of handling cement has been materially reduced. There were received 37,937,472 cement sacks, of which 33,605,055, or 89 per cent of the total, were returned to the United States. Of the sacks returned, 554,924, or not quite 1½ per cent, have been rejected. However, the percentage of rejections has more than doubled during the past fiscal year.

A number of field storehouses have been transferred to the department during the year.

Throughout the year material has been transferred on a very large scale. At the close of the previous fiscal year there was over \$400,000 stock at the Gorgona storehouse, which was transferred to Empire and Balboa during the months of July and August, 1913. Approximately \$100,000 worth of material was transferred from Miraflores to Empire, Balboa, and Mount Hope in September and October, 1913. Over \$100,000 worth of stock at Gatun was transferred to Mount Hope and Balboa. Over \$1,000,000 worth of stock was transferred from Empire to Balboa and Mount Hope during the first quarter of 1914. Over \$50,000 worth of material was transferred from Porto Bello and Toro Point to Mount Hope in April and May, 1914.

These various transfers have involved an immense amount of physical work and of paper work. The figures give no idea of the amount of detail involved in the checking, loading, shipping, unloading, rechecking, and restorage of the \$2,000,000 worth of material. It involved the physical transfer and shipment of over 30,000 tons of freight. The decrease in the amount of material received and handled over the docks has been more than offset by the additional expense and increased amount of work involved in these transfers. The actual labor expense alone of moving this material has been over \$50,000.

Besides the changes in the location of the work which have led to these transfers there has been a material change in the character of the material received and issued. The closing down of dry-excavation work involved a decrease in the amount of spare parts issued for steam shovels, well and rock drills, and rolling stock. There has been a large increase in the issues of building material, which include lumber, hardware, and plumbing material, and also a large increase in the amount of electrical material and dipper-dredge parts handled.

MOUNT HOPE.

Mount Hope depot has invoiced material to the value of \$7,093,963.28, as compared with \$10,580,623 during the previous fiscal year. The stock carried, exclusive of the obsolete storehouse, amounts to \$2,059,342.91. The decrease in the value of material invoiced was largely due to the decrease in dynamite and cement, little of which was actually handled by the depot in previous years. The closing of storehouses and the general clean-up in the divisions have resulted in very large quantities of material being returned to stock at Mount Hope. During the year material to the value of \$1,470,809.46 was turned in to Mount Hope depot by the various divisions and departments and by the various storehouses along the line. The handling, sorting, and restorage of this material has been a problem.

The operation of Dock 14 was turned over by the depot to the Panama Railroad on January 1, 1914. In the six months' period June to December, 1913, 27,237 tons of material were handled over this dock at a unit cost of 23.3 cents per ton.

The cost of operation at Mount Hope has been materially decreased during the year. More material is handled by cranes than heretofore, and the office expense and unskilled labor expense have been

largely reduced. Mount Hope yard and the substorehouses have been cleaned up and the material is physically in better shape than ever before.

Eventually it is intended to transfer the greater part of the active stock to Balboa and to make Balboa the depot and main source of supply for the permanent organization. The United States requisition division will, eventually, be transferred to Balboa, and Mount Hope used as a local storehouse for the local supply of the canal organization on the Atlantic side, and as a storehouse for surplus, obsolete, and retired equipment and material. A careful record is being kept of the shipments from Mount Hope to the various points along the line, and as soon as the proportion of shipments to the Pacific side reaches 75 or 80 per cent the move ought to be made.

PARAISO.

On account of the move of the headquarters of the dredging fleet and of the marine shops to Paraiso, it became necessary to establish storehouse facilities at that point. A portion of the old Paraiso shops was utilized as a storehouse. The greatest portion of the supplies of spare parts for dredges was transferred from Balboa and the dry-dock store at Cristobal to Paraiso. For some time, after the storehouse was established, the American Cement Tile Co. had a portion of the space, and for some months there was considerable confusion and inconvenience. However, the material has been straightened out, and the yard and storehouse are now in good shape. This storehouse carried a stock of \$325,076.69 on June 30, 1914.

GATUN.

Conditions at Gatun have been better than at any other point along the line, and it has been comparatively easy to transact business there. The storehouse at Gatun is practically on a permanent basis. The stock on June 30, 1914, was \$35,911.29.

BALBOA.

The stock on hand at Balboa June 30, 1914, was \$1,098,143.94. The issues at Balboa storehouse have increased from \$94,299.95 in July, 1913, to \$638,502.21 in June, 1914. The total issues during the year amounted to \$3,746,674.94. Conditions at this storehouse have been bad throughout the year. Up to the 1st of January, 1914, the old dredge storehouse, formerly used by the dredging division, was the only storehouse available. This building was equipped to do a business of about \$30,000 per month, but toward the latter part of our occupancy the issues amounted to several hundred thousands of dollars per month. As a result, material had to be scattered all over the yards at Balboa, and it was almost impossible to keep proper track of it. Beside the lack of storage space, the shops were being constructed, the yards were congested on account of the construction work going on at the dry dock and at the terminals, and it was almost impossible to get material promptly or properly switched. In February the old storehouse was abandoned and the material transferred to the new permanent storehouse, which was then far from complete. A force was working on this building up to the close of the year. The final completion of Building No. 3, the steel shed; and Building No. 10,

the lumber shed; helped matters, but it was not until June, 1914, that our facilities were in any sort of shape, and that we were enabled to begin to straighten out the material and store it properly. Of the permanent storage facilities at Balboa only the oil house remains to be constructed.

GENERAL.

Stocks on hand show an increase of approximately \$300,000 worth of material over stocks on hand at the close of the previous fiscal year. Of this \$108,000 represents the material for the gates at Balboa Dry Dock, which was turned over to the custody of this department during the past year. While every effort has been made to keep down stock and to work off old or surplus stock, the enormous amount of material turned in on account of the closing down of the work has caused an increase. While there still remains a large quantity of material to be turned in, it will not be as great as the shipments returned to stock during fiscal year 1914.

While the work of this branch of the department has been handled under trying conditions during the past year, it has been a necessary preparatory period for permanent operations. Our stock is more concentrated than ever before, and the work should in future be handled more easily and more economically.

SCRAP.

The collection, storage, classification, and sale of scrap has been an important feature of the work of the department during the year. Prior to July, 1912, the department had at different times handled the collection and sale of some American and French scrap, but no special organization was used for the purpose. During the fiscal year 1913 the Chicago House Wrecking Co. had a contract for the purchase of all American scrap which accumulated during that year, and the operations of the Quartermaster's Department were confined to the collection of scrap screening, copper and brass, rubber, and rope.

The contract with the Chicago House Wrecking Co. for the purchase of American scrap expired on June 30, 1913. Neither the commission nor the Chicago House Wrecking Co. desired to avail themselves of their option, under the contract, for a two-year extension. It was then realized that on account of the closing down of operations on various parts of the work there would be large quantities of scrap to be handled. These anticipations were fully realized, and it devolved on the supply department to organize the collection of scrap and to store, classify, and sell the scrap thus collected.

There being no one in the employ of the commission who had a practical knowledge of scrap, authority was obtained to secure a specialist in this line from the States. The services of Mr. D. C. Curtis, inspector of stores of the Chicago, Burlington & Quincy Railroad, were obtained, and he was mainly instrumental in creating the organization for the collection and classification of scrap. Much credit is due to Mr. Curtis for his work in this line.

Prior to the present fiscal year no real organized attempt had been made to recover scrap. The collection was limited to scrap that came out of the shops and was easily accessible, to the screening gathered up by the district quartermasters, and such small amounts of miscellaneous scrap as might be turned in by storekeepers and the construction

divisions. There was no real effort on the part of the construction division to save their scrap and turn it in. Many instances were found where foremen had thrown rail into the jungle and buried good iron and steel scrap, or valuable copper and brass scrap, in the dumps on the various parts of the work.

Mr. Curtis, in a series of inspections, covered the whole Isthmus, and the results of these inspections were reported to the storekeepers and district quartermasters of this department and to the various heads of departments and divisions interested. Under your authority, a circular was issued under date of February 3, 1914, impressing on all concerned the value of salvage, giving detailed instructions in regard to the collection of scrap and the importance of turning it in. These instructions had their effect and there was a marked improvement all over the work.

There were three periods during which very large quantities of scrap were collected and shipped to Mount Hope depot: First, when the Gorgona shops and storehouse closed down. In August, 1913, the storekeeper at Gorgona and the mechanical division shipped over a thousand tons of scrap to the depot. Second, when tracks in the Culebra Cut were taken up in August and September. Several hundred cars, with several thousand tons of rail and fittings were collected and turned in by the fourth division. Third, when work on the west side of the canal at Pedro Miguel and Miraflores was finished in September and October. Large quantities of rail and scrap were turned in and shipped by the fifth division to Mount Hope.

While a large tonnage of scrap and rail was received in this manner, it was found that a thorough clean-up had not been made by the construction gangs. Scrap gangs were organized by this department which took down and cut up the berm cranes, and shipped in the scrap recovered from these cranes at Miraflores and all scrap on the east side of the canal at Miraflores and Corozal. The district quartermaster at Gatun organized a gang which collected all rail and scrap on the west side of the canal at Gatun. Another gang collected and shipped scrap in the vicinity of Empire.

A contract was given to Mr. D. E. Fulton to collect all scrap on the east side of the canal, between Gamboa and the Empire suspension bridge, a unit price per pound being paid for copper and brass and a unit price per ton for rail and iron and steel scrap. Over 20,000 pounds of copper and brass and several hundred tons of good rail and scrap steel and iron were recovered by Mr. Fulton. At inaccessible points the cost of supervision is very expensive, and the contract method is more economical.

Fifteen thousand two hundred net tons of miscellaneous iron and steel scrap and 7,944 gross tons of serviceable 30-pound, 40-pound, 70-pound, and 90-pound rail were shipped to Mount Hope during the fiscal year. There were also shipped 6,178 gross tons of scrap rail and 931 gross tons of serviceable and unserviceable track fittings. Altogether a total of 30,000 tons of rail and scrap were handled at the scrap yard at Mount Hope.

Copper and brass is the most valuable scrap and a special attempt has been made to recover this class of material. Prior to the present fiscal year salvage of copper and brass scrap was limited to what came out of the brass foundry and from the shops. During the past year the district quartermasters, storekeepers, the electrical division,

and the telephone and signal department of the Panama Railroad recovered and turned in large quantities of this class of scrap. The total amount turned in was 706,142 pounds, valued at approximately \$70,000. Over 75,037 pounds of screening, 92,579 pounds of lead, and 239,814 pounds of rubber were recovered and shipped in, the value of the miscellaneous scrap amounting to over \$15,000.

In August, 1913, scrap yard No. 3 was laid out at Mount Hope. This yard was later extended on the other side of the coal pile and the work of unloading, sorting, and classifying 30,000 tons of rail, fittings, and scrap was undertaken. The task was a difficult one, as our forces were cramped for room on account of the failure of the Chicago House Wrecking Co. to remove the American scrap from its yard, and on account of the fact that we had no practical scrap foremen and trained laborers. Competent scrap foremen were finally obtained and the gangs trained to their work. A system of task work was inaugurated which materially reduced expenses. The small Panama Railroad locomotives were scrapped for approximately \$40 each, whereas it had formerly cost \$100 each. Lidgerwood cars were scrapped on a task basis at a cost of approximately \$4 each.

The scrap classification of the Railway Storekeepers' Association was adopted and the scrap sorted according to this classification. Prior to this year no attempt had been made to sort the scrap, with the result that what material was shipped by the commission brought very low prices. The sorting of the scrap adds 50 cents to \$2 per ton to the price realized and the cost of sorting is not over 25 cents per ton. The cost of loading and shipping is also reduced when the scrap is sorted.

Approximately \$80,000 worth of scrap has been sold during the year. On account of poor business conditions in the States, the market has been very low and very little of the iron and steel scrap has been put on the market, it being considered best to hold this material until there is some improvement. During the year 2,677 tons of lock forms and 2,683 tons of miscellaneous scrap were sold and delivered to Mr. M. Rovetta. With this exception and two or three small shipments which were sent to the States to test the market, no iron and steel scrap has been sold. The material delivered to Mr. Rovetta brought approximately \$26,000. There were also sold 296,395 pounds of copper and brass scrap, the net receipts being \$31,201.50. One hundred and twenty-five thousand pounds of copper and brass were also issued to the Gorgona foundry. The amount of copper and brass scrap recovered has been far in excess of that needed by the foundry, and it has not been necessary to purchase any new ingot copper from the States. There were sold 90,615 pounds of screening, the net receipts being \$9,307.97. Over 50 per cent more screening was collected and sold than during the previous fiscal year. One hundred and thirty-four thousand two hundred and ten pounds of rope were sold, net receipts being \$2,383.06. The amount of rope recovered during the year was almost equal to the total recovered during the previous seven fiscal years. Besides the above, some rubber hose, belting, and leather was sold. The price of rope, copper and brass, screening, and belting compared favorably with previous years. The rubber market was much lower, and the prices averaged considerably less than during the previous years.

The table below shows the quantities of miscellaneous States sales:

	Quantity (pounds).	Average selling price per hun- dred weight.	Gross.	Net
Screening.....	90,615	\$10.77	\$9,759.24	\$9,307.97
Rope.....	134,210	2.19	2,925.86	2,383.06
Belting and leather.....	12,903	7.45	961.24	933.29
Rubber and hose.....	155,302	1.66	2,589.02	2,121.50
Copper and brass.....	296,395	1.069	31,692.13	31,201.50
Total.....			47,927.49	45,947.32

Besides the sales of scrap amounting to \$80,000, there is scrap on hand at Mount Hope to the value of \$300,000, the values being based on the present low market prices of scrap. All of this scrap is salable and can be converted into cash at any time it is deemed expedient.

The expense of scrap operations proper has amounted to approximately \$25,000 for the year.

The scrap contracts with the Chicago House Wrecking Co. have continued to cause much difficulty and controversy. Under their contract for the purchase of French scrap, they have removed 3,743,059 pounds and paid \$14,791.87 during the fiscal year, making a total of 3,563 tons of French scrap removed and a total of \$28,705.79 paid up to June 30, 1914, out of the \$215,000 which was agreed upon as the purchase price of this scrap.

Several boards have been convened during the year to pass upon and decide the various claims at issue, and decision was rendered by you during the course of the year that this company was entitled, under the French scrap contract, to remove all French scrap not credited to the scrap account which was not in use at the time the contract was closed in 1911. The Chicago House Wrecking Co. did not accept this decision and the question is now pending before the Secretary of War.

Similar difficulties have been encountered in the contract for the purchase of the American scrap. Although the contract with this company expired June 30, 1913, and instructions were issued by you to remove this scrap by November 1, 1913, but 1,375,304 pounds were removed during the year and but \$4,623.44 paid. Altogether 3,072 tons of scrap have been delivered under this contract, for which they have paid \$23,134.16. Approximately 11,199,919 pounds of scrap are still to be removed and \$37,649.72 is yet due from the company.

The problem of collection and removal of scrap will not be as difficult as it has been during the past year due to the fact that the force has been trained and that we have competent foremen to handle it. It will take, however, fully a year to collect and clean up all of the scrap yet remaining on the Isthmus and, probably, two years to ship and dispose of all of it.

SALES.

It was stated in the last annual report that "the storage, disposition, and sale of this surplus and obsolete material and retired equipment during the fiscal year 1914 will be a difficult problem * * *." These anticipations were fully realized.

The practical completion of dry excavation in the canal, the completion of masonry work in the locks, the closing of the Gorgona and Empire shops caused the retirement of many units of equipment, the original value of which ran into the millions of dollars. Hundreds of cars, steam shovels, locomotives, and large quantities of shop tools, boilers, and all kinds of miscellaneous equipment were retired and turned over to this department for sale or for scrap. Large quantities of spare parts for this equipment were also turned in to be disposed of.

The sundry civil bill contained the following provision:

SEC. 8. That until the close of the fiscal year 1914, when any material, supplies, and equipment heretofore or hereafter purchased or acquired for the construction of the Panama Canal is no longer needed, or is no longer serviceable, it may be sold in such manner as the President may direct, and without advertising in such classes of cases as may be authorized by him.

The President gave authority to the chairman and chief engineer of the Isthmian Canal Commission to sell upon such terms as he might approve, and without advertising, any material, supplies, and equipment no longer needed or no longer serviceable. The authority thus conferred was sufficiently broad to enable the authorities on the Isthmus to dispose, with the least amount of red tape and to the best advantage possible, the equipment and material thus retired.

Prior to the present fiscal year, procedure on the Isthmus for the appraisal and sale of equipment was inadequate and clumsy. Circular 399-A, dated June 25, 1913, placed the appraisal of all material and equipment in the hands of a board of appraisal and the sale in the hands of the chief quartermaster. This circular was later modified and the responsibility centered in the chief quartermaster, upon whom devolved the appraisal and sale of all retired equipment and material.

Prior to the present fiscal year such equipment as was retired from the work, received no treatment and with the exception of small tools was stored in the open. It was realized that units like locomotives and steam shovels, the unit value of which was over \$10,000 each, would deteriorate rapidly, and if not sold shortly after their retirement would result in only scrap values being obtained.

With the cooperation of the mechanical division, the method of handling retired equipment was worked out. This equipment when retired and surveyed for sale is turned over to the mechanical division for preparation for storage, and after being prepared is turned over to the supply department for storage and sale.

The table below shows the number of units prepared for storage with unit costs of preparation:

Class.	Number.	Total cost.	Unit cost.
Locomotives:			
201.....	13	\$1,364.59	\$104.97
301.....	27	2,398.74	88.84
601.....	15	1,207.14	80.48
	55	4,970.47	90.37
Steam shovels:			
50.....	3	311.69	103.90
101.....	11	845.78	76.89
201.....	18	1,424.26	79.13
251.....	6	496.03	82.67
	38	3,077.76	80.99
Unloaders.....	11	631.97	57.45
Scrapers.....	7	314.60	44.94
Pile drivers.....	2	78.94	39.47
Track shifter.....	1	52.45	52.45

The total charges thus far have amounted to \$14,222.84, which is absolutely a large sum, but relatively a small sum. This work will eventually save the canal money. Where equipment was not prepared for storage, as in the case of the first steam shovels retired and stored at Mount Hope, the sale value has been lowered at least 50 per cent.

Two storage yards were established, one at Gamboa for steam shovels, the other on the relocation dumps for locomotives, cars, unloaders, spreaders, track shifters, and pile drivers. After the Empire shops were closed down in April, the covered sheds in these shops were utilized for the storage of steam shovels and locomotives. Watchmen are kept at the storage yards to see that the equipment is not robbed and to report any of it that needs retouching.

All shop tools, boilers, mixers, narrow gauge equipment, and miscellaneous items of material are shipped to the storehouse for obsolete material at Mount Hope, which is used as a general clearing house for sales and reissues of equipment. Material to the value of \$1,065,123.24 was received during the year at the obsolete storehouse, of which material \$143,892.31 was either reissued to other departments, returned to stock, or sold. Seventy two thousand dollars' worth of material was reissued or returned to stock, and approximately \$71,000 worth was sold. The values given above for reissues and sales are the actual appraised values, the values given to material received were the original or survey price, which in most cases is considerably above the appraised or sale value. The appraised value of material on hand at the obsolete store on June 30, 1914, exclusive of scrap or retired equipment is \$76,519; the value of the locomotives, steam shovels, spreaders, pile drivers, and other units of equipment, with the exception of cars, is \$234,616. The cost of the operation of the store for the fiscal year chargeable to sales was \$11,270.13.

A catalogue of all equipment purchased by the commission and the Panama Railroad was prepared giving complete information covering the date of purchase, cost, and description of all units. This catalogue was distributed by the Washington office and by this department to equipment firms and to railroads all over the United States and to firms in Europe, Australia, and South America. While not originally intended for the purpose, the catalogue was in great demand by departments and divisions on the Isthmus, as it was the first complete summary in handy form of equipment owned by the commission and by the railroad.

While the catalogue proved its usefulness and brought us many inquiries and was the cause of many sales, it was found that in itself it was not enough to consummate sales, particularly in the United States. Mr. C. T. Cushman, formerly handling sales in this office, was sent to New York to attempt to push the sales of retired equipment in the United States and to receive and handle any shipments of scrap and equipment that might be sent to the United States.

The medical storehouse was taken over by the supply department on April 1 and returned to the health department on July 1. During its administration of this storehouse, the supply department endeavored to work off a large stock of surplus material that had accumulated. Altogether, material the original value of which was \$32,846.85 was sold for \$9,419.55. Material to the value of \$22,654.53 was sold

under advertisement, the price realized being \$3,846.21, or approximately 17 per cent of the original purchase price. Material to the value of approximately \$10,000 was sold direct, the amount realized being approximately \$5,600, or approximately 55 per cent of the original purchase price. Of the material sold direct, the Venezuelan Government purchased \$3,771.51 worth and the United Fruit Co. \$1,275.

Altogether, the total sales are shown in the table below:

Scrap (including torn cement bags, \$1,708.89), gross.....	\$100,782.01
Surplus and obsolete material, gross.....	272,355.68
Panama R. R. and commissary, gross.....	960,072.53
Other sales, gross.....	155,300.90
Total.....	1,488,511.12

It will be noted that the surplus and obsolete material sold amounted to \$272,355.68, and other sales, which principally included material from stock, amounted to \$155,300.90. In view of the fact that business conditions are bad all over the world and that there has been practically no demand for second-hand machinery and equipment in the United States, the results obtained are very encouraging and much more than we had a right to expect. Moreover, the prices realized have been far above scrap value and far above what we could have realized by advertising the material, at least, if the bids submitted under previous advertisements were any criterion of what we would have obtained by advertising.

The principal items of equipment sold embrace:

Steam shovels.....	18
Narrow-gauge locomotives.....	24
Narrow-gauge dump cars.....	41
12-yard dump cars.....	55
Steel flat car.....	1
Cranes.....	2
Unloaders.....	4
Pile driver.....	1
Star well drills.....	11
Barges.....	3
Clapet.....	1
Dredge.....	1
Tug boat.....	1
Rock crushers.....	5
Tons of relay rail.....	3,758

Exhibit No. 19, appended, shows units of rolling stock retired for sale, for scrap, the number scrapped, sold, reserved for use, and in use.

The largest purchasers have been the United Fruit Co., who have bought over \$108,821 worth of equipment for their railroads in Panama, Costa Rica, Honduras, and Guatemala; the Chile Exploration Co., who have purchased \$50,000 worth of equipment and rail for their copper mines at Chuquicamata, Chile; the France Co., of Toledo, Ohio, who purchased a portion of the Porto Bello rock-crusher plant and three of the steam shovels, at a cost of \$25,700; the Venezuelan Government, who purchased \$30,000 worth of second-hand and surplus stock material. Beside the above, we have sold to employees \$22,000 worth of material; to the Army and Marine Corps, \$29,000 worth; to contractors with the commission, \$46,000 worth; and to the Republic of Panama, \$17,000 worth. The four last named have bought principally stock material.

We have had no difficulty in disposing of the retired narrow-gauge equipment. We had little difficulty in disposing of the smaller sizes of steam shovels. Our rail has practically sold itself, and there is a market for every ton of rail that we may have available. The small tools and equipment have been readily salable. Thus far it has been impossible to sell any of the large locomotives, but few of the larger sizes of steam shovels, none of the handling plants or cableways, and very few of the unloaders, spreaders, and special items of equipment. There will be a ready market for any of the floating equipment that we may have to retire. It is my belief that the sale of the locomotives and some of the large items of equipment can be handled to best advantage through some large equipment firm operating in the United States, on a commission basis. We can handle the rail, scrap, the narrow-gauge equipment, and the smaller items of equipment ourselves without paying any commission.

SUBSISTENCE.

The subsistence department was consolidated with the quartermaster's department, under the title of the "supply department," on April 1, 1914.

The hotels and messes which heretofore had been operated under stewards, reporting direct to the assistant subsistence officer, were placed, for purpose of administration and discipline, under the jurisdiction of the district quartermasters, with the exception of the Tivoli, Washington, and Aspinwall Hotels and the Panama Railroad restaurant at Colon. The policy and general administration of the hotels and messes was continued under the direction of Capt. F. O. Whitlock, assistant chief quartermaster, assisted by Inspector H. C. Keyes.

There was a decided decline in the number of meals furnished at the hotels and in the number of rations furnished in the messes, this being due to the decrease in force. It is probable that the business at the hotels and messes will continue to decrease during the coming fiscal year. Eventually, I believe, it will be to the best interests of the canal, as soon as the force is on a permanent basis, and as soon as the quarters situation becomes easier, to allow bachelor employees on the gold roll, who may desire to do so, to run their own messes. The business of the hotels will then be confined to transients and new employees.

Details of the operations of the hotels and messes in the past year, as submitted by Capt. Whitlock, are furnished below:

The European laborers' messes and the common laborers' kitchens were combined immediately after July 1, 1913, and called "laborers' messes." The 40-cent per day rations and the 27-cent per day rations were continued as formerly, but both were prepared and served from the laborers' messes. The laborers' mess rations considered in this report are on the 40-cent basis, as all 27-cent rations served were considered and reported as twenty-seven-fortieths of a regular 40-cent ration. The laborers' messes, organized as outlined above, have given satisfaction throughout the year.

On June 30, 1914, the subsistence branch was operating the Hotel Tivoli, 12 line hotels and the Hotel Aspinwall, and 10 laborers' messes, a decrease of 4 hotels and 5 messes from last year. The

hotels at Porto Bello, Gorgona, Dump No. 6, Bas Obispo, Las Cascadas, and Miraflores were closed, and the Ancon mess for gold employees and the Hotel Aspinwall on Taboga Island, were opened. The messes at Dump No. 6, Bas Obispo, Culebra, Gorgona, Miraflores, and Porto Bello were closed and the common laborers' kitchen at Naos Island was converted into a laborers' mess.

A chief steward has been in charge of the line hotels, restaurants, and laborers' messes in each of the various districts, and since the reorganization of April 1, 1914, their work has been supervised by the various district quartermasters. This supervision, however, did not extend to the Hotel Aspinwall. It, like the Hotel Tivoli, was independent under its own manager. The Hotel Aspinwall, formerly the Taboga Sanitarium, located on Taboga Island in the Bay of Panama, was taken over from the sanitary department on January 16, 1914. It is for the benefit of employees and their families, and it gives a place, easily accessible, where anyone can quickly recuperate if in a run-down condition. From January 16 to June 30, 1914, the Hotel Aspinwall was operated at a loss of \$2,504.64.

The total revenue for the year from the line hotels, restaurants, and messes was \$1,032,189.51, a decrease of \$202,888.33 from last year, while the total cost of operations was \$1,021,856.92, a decrease of \$183,943.84, making the profit \$10,332.59, a decrease of \$18,944.49 from last year. The ratio of supplies consumed to revenue was 9.03 per cent less than last year, making the ratio of total cost of operations to revenue 1.37 per cent more than last year. The percentage of profit to revenue was 1 per cent, 1.37 per cent less than last year. The net expense for salaries and wages was \$133,638.81, a decrease of \$32,759.84, making the proportion of net payroll to revenue 12.95 per cent, 0.52 per cent less than last year.

The total number of meals served in line hotels was 2,131,912, a decrease of 208,732 (8.91 per cent) from last year. The average cost of supplies per meal was 25.34 cents, an increase of 0.70 cent from last year, while the average cost of service was 5.77 cents, an increase of 0.25 cent, making an increase in the total cost per meal of 0.95 cent over last year. The total number of rations served in laborers' messes was 950,994, or 296,004 (23.74 per cent) less than last year, while the average cost of supplies per ration was 31.27 cents, a decrease of 0.37 cent, and the average cost of service was 5.71 cents, an increase of 0.01 cent, making a decrease from last year in the total cost per ration of 0.36 cent. In this comparison of mess rations, it has been necessary to consider a kitchen ration of last year, as twenty-seven fortieths of a mess ration.

The following table shows the relative value of food consumed per meal in the line hotels:

Meats and fish, fresh.....	\$7. 61
Meats and fish, canned.....	. 15
Meats and fish, cured, and lard.....	2. 05
Butter and oleo.....	2. 07
Eggs.....	2. 93
Fruits and vegetables, fresh.....	3. 58
Fruits and vegetables, canned and jams.....	2. 20
Fruits and vegetables, dried.....	. 28
Coffee, tea, and cocoa.....	. 53
Milk.....	. 69
Sugar and sirups.....	. 68

Bread and cake.....	\$0.83
Flour.....	.47
Ice cream.....	1.44
Miscellaneous.....	1.41
Total.....	26.92

The operations of the Hotel Tivoli for the year resulted in a net profit of \$21,271.25. The great crowds that we were called upon to take care of during the previous two years did not visit the Isthmus during this past year.

Due to the decrease in force of The Panama Canal and the Panama Railroad, the business of the line hotels and laborers' messes has fallen off during the year, but attention is called to the fact that our expenses fell off correspondingly.

Tables showing details of the financial operations for the fiscal year are attached hereto.

COMMISSARY BRANCH.

The administration and operation of the Panama Railroad commissaries were transferred to the supply department on April 1, 1914. The supply department operates the commissaries and manufacturing plants for the account of the Panama Railroad; employees of the commissaries are carried on the Panama Railroad pay rolls and any expenses and revenues come from and accrue to Panama Railroad funds.

Some radical changes were made in the organization of the commissary branch after the consolidation. The positions of manager of commissaries and superintendent of manufacturing plants were eliminated. One of the two inspectors of commissaries was eliminated. The position of depot commissary was created.

The wholesale business, embracing the business of the manufacturing plants and the wholesale warehouses at Cristobal, was placed under the control of the depot commissary, upon whom devolves the responsibility for the proper upkeep of stock. The various line commissaries were placed for purpose of administration and discipline under the various district quartermasters, with the exception of the terminal commissaries—Cristobal, Camp Bierd, Balboa, and La Boca—which were handled as separate units.

On account of the approaching removal of the general offices to Balboa, a temporary organization was effected by which the assistant chief quartermaster remained at Cristobal in charge of the purchasing and with supervision over the depot commissary, while the inspector of commissaries was transferred to Culebra, and the various line storekeepers report through the district quartermasters to the chief quartermaster. Ultimately the supervision of all commissary matters will be transferred to the main offices at Balboa.

Especial attention has been given to the foreign purchases which have heretofore been handled on the Isthmus. The bulk of foreign purchases were handled through agents in Hamburg and London. Efforts have been made to buy direct from the manufacturers and these efforts have met with unexpected success. By direct purchase \$15,000 per annum is saved on one commodity alone.

For some time no definite written guide had existed for the pricing of commodities in the commissaries. Fixed surcharges are now

placed on the various classes of commodities and these prices can not be changed, except by direction of the chief quartermaster.

As beef had been selling below cost f. o. b. docks Colon, the price was raised and the price on other commodities lowered.

Attempt was made to reform the selling method in vogue in the various line commissaries. Special attempts were made to improve the service, requests for comments and suggestions being sent out to patrons. A number of helpful and practical suggestions were received from patrons. It is believed that a marked improvement has been made in this regard.

A large wholesale warehouse is in course of construction at Cristobal. When this warehouse is completed the plants and wholesale warehouse of the commissary branch will be concentrated, and it is anticipated that better service and decreased costs will result.

A new concrete commissary was completed at Ancon and opened for business on June 15, 1914.

In the past the greatest aid to commissary operations has been in the immense volume of business transacted, which has enabled us to buy at comparatively low prices and to sell with relatively little expense. Whether the business to be done with ships passing through the canal and with the various departments of the Government, such as the Army and Navy, will make up for the decrease in business from individual employees is a question. It is believed that we ought to rigidly adhere to the policy of supplying all departments of the Government from the canal organization.

However, in the face of decreased business, we have been able to cut costs correspondingly.

The financial operations of the commissary branch will be embodied in the report of the Panama Railroad.

Respectfully submitted.

R. E. Wood,
Chief Quartermaster.

Col. GEORGE W. GOETHALS, United States Army,
Governor, Panama Canal, Balboa Heights, Canal Zone.

EXHIBIT 1.—*Force actually at work on June 30, 1914.*

Department or division.	Silver employees (wages specified are in United States currency).												Total.		Grand total.	
	Month-ly.	Artisans.					Special.	Laborers.								Silver.	Gold.
		Special.	22 cents.	18 cents.	15 cents.	12 cents.		European.								
								16 cents.	13 cents.	10 cents.	7 cents.	5 cents.				
Operation and maintenance:																
Terminal construction.....	544	.....	22	148	418	196	532	358	434	23	27	2,702	289	2,991		
Erection.....	92	7	52	225	574	215	2	150	222	.....	10	1,549	305	1,854		
Electrical.....	58	13	18	30	62	97	.....	46	114	.....	.....	438	192	630		
Municipal engineering.....	256	.....	67	232	291	.....	76	88	738	6	14	2,120	103	2,223		
Engineer of maintenance.....	34	1	.....	1	.....	.....	.....	.....	.....	.....	.....	36	26	62		
Dredging.....	1,760	5	4	12	41	.....	39	132	.....	1	3	1,998	284	2,282		
Mechanical.....	1,179	16	61	146	604	691	12	230	187	10	18	2,154	878	3,032		
Canal transportation.....	35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35	24	59		
Fortification.....	158	4	57	126	417	80	19	500	109	1	7	1,478	106	1,584		
General construction.....	42	5	4	14	16	.....	150	62	167	.....	9	469	23	492		
Total.....	3,158	51	285	934	2,484	1,570	830	1,566	1,971	41	88	12,979	2,230	15,209		
Supply:																
Main office.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	37	41		
Commissary.....	701	1	1	.....	11	10	.....	.....	130	85	.....	939	190	1,129		
Subsistence.....	595	.....	2	1	.....	.....	.....	.....	.....	21	.....	619	24	643		
Quartermaster.....	959	463	222	518	1,021	208	68	1,037	1,307	2	26	5,879	540	6,419		
Accounting.....	12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	140	152		
Health.....	495	.....	.....	1	4	.....	.....	13	331	3	39	886	211	1,097		
Executive.....	178	2	.....	1	.....	.....	.....	.....	.....	.....	.....	181	418	599		
Panama R. R.....	452	145	101	236	264	.....	350	365	789	26	20	3,901	442	4,343		
Contractors.....	16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	25	41		
Total.....	6,570	662	611	1,691	3,784	1,788	1,248	2,081	4,528	178	173	25,416	4,257	29,673		

EXHIBIT 2.—*Force report by months, fiscal year 1913-14, including contractors' forces.*

Year and month.	The Panama Canal.		Panama R. R. Co.		Contractors' forces.		Grand total.
	Gold.	Silver.	Gold.	Silver.	Gold.	Silver.	
1913.							
July.....	4, 173	29, 657	779	4, 497	549	2, 829	42, 484
August.....	4, 087	30, 918	758	4, 199	524	2, 399	42, 885
September.....	3, 786	28, 480	738	4, 526	433	1, 849	39, 812
October.....	3, 685	26, 032	717	4, 344	322	1, 326	36, 426
November.....	3, 695	24, 592	723	4, 834	257	866	34, 967
December.....	3, 744	23, 209	728	4, 467	81	334	32, 563
1914.							
January.....	3, 944	23, 824	752	4, 750	78	271	33, 619
February.....	3, 908	22, 909	713	4, 006	66	199	31, 801
March.....	3, 527	21, 844	670	4, 899	14	20	30, 974
April.....	4, 005	23, 386	424	3, 838	28	13	31, 694
May.....	3, 901	22, 349	448	4, 323	17	12	31, 050
June.....	3, 790	21, 499	442	3, 901	25	16	29, 673

EXHIBIT 3.—*High and low force records, December, 1906, to June 30, 1914.*

Year and month.	The Panama Canal.			Panama R. R.	Total Panama Canal and Panama R. R.
	Gold.	Silver.	Total.	Gold and silver.	
1906.					
December	3, 881	15, 604	19, 485	4, 416	23, 901
1907.					
October	4, 992	20, 836	25, 828	6, 139	31, 967
January	4, 033	16, 987	21, 020	4, 796	25, 816
1908.					
April	4, 950	21, 168	26, 118	7, 052	33, 170
November	4, 161	19, 803	23, 964	5, 863	29, 827
1909.					
October	4, 376	23, 411	27, 787	7, 618	35, 495
January	4, 295	20, 583	24, 878	6, 393	31, 271
1910.					
March	4, 553	26, 284	30, 837	7, 839	38, 676
December	4, 705	24, 383	29, 093	6, 044	35, 142
1911.					
December	4, 420	25, 439	29, 859	7, 967	37, 826
June	4, 292	21, 795	26, 087	6, 603	32, 690
1912.					
January	4, 332	25, 818	30, 150	8, 024	38, 174
August	4, 122	24, 860	28, 982	5, 855	34, 837
1913.					
August	4, 087	30, 918	35, 005	4, 957	39, 962
December	3, 744	23, 209	26, 953	5, 195	32, 148
1914.					
January	3, 944	23, 824	27, 768	5, 502	33, 270
June	3, 790	21, 499	25, 289	4, 343	29, 632

NOTE.—Figures do not include contractors' forces. If taken into consideration, the greatest working force ever reported was 44,733, on Mar. 26, 1913.

EXHIBIT 4.—*Contract laborers brought to the Isthmus by the Isthmian Canal Commission.*

Country.	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	Total.
Spain.....			1,174	5,293	1,831						8,298
Cuba.....			500								500
Italy.....			909	1,032							1,941
Greece.....				1,101							1,101
France.....			19								19
Armenia.....			14								14
Total Europeans.....			2,616	7,426	1,831						11,873
Fortune Island.....			361								361
Barbados.....	404	3,019	6,510	3,242	2,592	3,605				528	19,900
Guadeloupe.....				2,039					14		2,053
Martinique.....		2,733	585	2,224							5,542
Jamaica.....		47									47
Trinidad.....			1,079				205		143		1,427
Curacao.....			23								23
St. Kitts.....			933						9		942
St. Lucia.....									55		55
St. Vincent.....									296		296
Grenada.....									93		93
British Guiana.....									332		332
Total West Indians.....	404	5,799	9,491	7,505	2,592	3,605	205		942	528	31,071
Costa Rica.....		244									244
Colombia.....		1,077	416								1,493
Panama.....		334	10	13							357
Not classified.....			69								69
Grand total.....	404	7,454	12,602	14,944	4,423	3,605	205		942	528	45,107

EXHIBIT 5.—Analysis of transportation from the Isthmus, fiscal year 1913-14.

Reason for free transportation.	1913											
	July.		August.		September.		October.		November.		December.	
	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.
United States of America:												
Complimentary.....	2	\$80.00	9	\$310.00	6	\$272.50	3	\$62.00	7	\$296.25	6	\$190.00
Deportation.....	1	15.00	1	15.00	2	30.00			2	30.00	2	30.00
Reduction of force.....	5	200.00	6	240.00	122	4,787.50	59	2,360.00	19	760.00	20	800.00
Reorganization.....												
Sickness.....	2	55.00	2	80.00			2	80.00	1	40.00	1	40.00
Two years' service.....	93	3,720.00	61	2,440.00	81	3,240.00	75	2,975.00	67	2,680.00	60	2,440.00
Remains of employees.....	2	80.00	1	40.00	1	40.00			1	40.00		
Total.....	105	4,150.00	80	3,125.00	212	8,370.00	139	5,477.00	97	3,846.25	89	3,500.00
South America and West Indies:												
Complimentary.....	7	92.00	7	70.00	10	90.50	14	138.00	13	273.50	51	1,397.62
Repatriation.....	39	412.28	20	211.64	54	571.12	31	327.36	32	337.92	111	1,180.86
Sickness.....	9	109.50	7	102.00	9	131.50	2	12.00	37	303.20	9	124.82
Undesirables.....	7	85.50	3	33.00	6	76.00	3	39.00	4	50.00	24	263.50
Total.....	62	699.28	37	416.64	79	869.12	50	516.36	86	964.62	195	2,966.80
Europe:												
Complimentary.....	2	72.40			71	2,547.40	254	9,035.29	117	3,978.60	255	8,982.40
Sickness.....	2	46.00	6	186.00	7	234.80	3	108.50			3	76.40
Undesirables.....	1	16.00	1	35.00	5	54.20	2	72.40	1	15.00	1	15.00
Total.....	5	134.40	7	221.00	83	2,836.40	259	9,216.19	118	3,993.60	259	9,073.80
Grand total.....	172	4,983.68	124	3,762.64	374	12,075.52	448	15,209.55	301	8,804.47	543	15,540.60

EXHIBIT 5.—Analysis of transportation from the Isthmus, fiscal year 1913-14.—Continued.

Reason for free transportation.	1914.												Total.	
	January.		February.		March.		April.		May.		June.			
	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.
United States of America:														
Complimentary.....	6	\$190.00	4	\$110.00	2	\$55.00	48	\$1,922.50	23	\$853.00	4	\$135.00	120	\$4,476.25
Deportation.....									1	15.00	2	30.00	11	165.00
Reduction of force.....	19	760.00	18	720.00	15	600.00	39	1,560.00	9	360.00	10	400.00	341	13,547.50
Reorganization.....							35	1,375.00					35	1,375.00
Sickness.....	2	80.00	1	40.00	2	80.00	3	120.00	4	160.00	1	40.00	21	815.00
Two years' service.....	42	1,672.00	31	1,240.00	47	1,880.00	126	5,015.00	62	2,473.75	79	1,167.50	824	30,943.25
Remains of employees.....			1	40.00	3	120.00							9	360.00
Total.....	69	2,702.00	55	2,150.00	69	2,735.00	251	9,992.50	99	3,861.75	96	1,772.50	1,361	51,682.00
South America and West Indies:														
Complimentary.....	20	148.00	16	152.92	27	255.18	17	179.18	43	367.00	36	278.50	261	3,442.40
Repatriation.....	52	550.00	16	169.40	85	898.04	85	899.36	74	778.34	108	1,069.48	707	7,405.80
Sickness.....	6	80.76	3	22.56	5	54.06	4	40.00	5	62.00	4	56.00	100	1,098.40
Undesirables.....	14	201.20	10	104.00	11	128.56	3	51.00	7	87.50	13	148.50	105	1,267.76
Total.....	92	979.96	45	448.88	128	1,335.84	109	1,169.54	129	1,294.84	161	1,552.48	1,173	13,214.36
Europe:														
Complimentary.....	351	12,374.25	79	2,927.70	42	1,486.60	106	3,735.60	153	5,434.60	137	4,873.90	1,567	55,448.74
Sickness.....	1	36.20	3	104.30	1	35.00	1	36.20	3	108.60	2	134.20	32	1,106.20
Undesirables.....			1	13.00	1	5.00	2	62.70			1	36.20	16	314.50
Total.....	352	12,410.45	83	3,045.00	44	1,528.60	109	3,824.50	156	5,543.20	140	5,044.30	1,615	56,869.44
Grand total.....	513	16,092.41	183	5,643.88	241	5,597.44	469	14,986.54	384	10,699.79	397	8,369.28	4,149	121,765.80

EXHIBIT 6.—*Occupants of Panama Canal and Panama Railroad quarters June 30, 1914.*

Place.	Gold.			Europeans.			West Indians.			Total.
	Men.	Women.	Children.	Men.	Women.	Children.	Men.	Women.	Children.	
Balboa.....	560	38	31	403	15	23	1,561	433	523	3,587
Ancon ¹	800	325	267	.....	.....	.....	644	39	4	2,079
Corozal ²	779	201	243	222	.....	.....	701	39	37	2,222
Pedro Miguel.....	191	106	116	71	.....	.....	193	.....	.....	677
Paraiso.....	275	65	83	124	6	18	318	92	151	1,132
Culebra ³	551	316	306	67	30	47	657	301	408	2,683
Gatun.....	366	173	173	245	5	16	422	37	47	1,484
Cristobal ⁴	899	365	398	186	.....	.....	1,404	159	356	3,767
Toro Point.....	11	.....	.....	.....	.....	.....	296	.....	.....	307
Total.....	4,432	1,589	1,617	1,318	56	104	6,196	1,100	1,526	17,938

¹ Includes Sabanas police station, Taboga Island, Naos Island, Culebra Island, and Palo Seco.² Includes Miraflores.³ Includes Empire, Las Cascadas, and Bas Obispo.⁴ Includes Colon Beach and Colon Hospital.

Gold force of contractors, included above, 30 bachelors.

EXHIBIT 7.—*Applications for married quarters on file June 30, 1914.*

Stations.	List No. 1.	List No. 2.
Ancon.....	88 (71)	457 (190)
Ancon Hospital.....	.....	9
Corozal.....	23 (23)	199 (94)
Paraiso.....	.....	150 (27)
Gatun.....	1	104 (1)
Cristobal.....	.....	157 (41)
Total.....	112 (94)	1,076 (353)

NOTE.—The figures in parenthesis show the number of applicants already occupying regular or nonhouse-keeping family quarters at stations other than those at which applications are filed.

EXHIBIT 8.—*Animals in corrals June 30, 1914.*

Stations.	American horses.	Native ponies.	Mules.	Police ponies.	Private animals.	Total.
Ancon.....	28	9	247	12	22	318
Corozal.....	1	.....	17	1	9	28
Paraiso.....	1	2	34	5	7	49
Culebra.....	10	4	48	6	16	84
Gatun.....	2	.....	26	4	.....	32
Cristobal.....	17	1	178	.....	7	103
Total.....	59	16	450	28	61	614

¹ Includes 7 Panama R. R. (commissary) mules.

EXHIBIT 9.—*Number of buildings on the Canal Zone June 30, 1914.*

	Panama Canal.	French.	Panama R. R.	Private.	Total.
Alhajuela.....	2	2			4
Ancon.....	259	38	2		299
Balboa.....	270	1	6		277
Bas Obispo.....	58	92	4		154
Camp "E. S. Otis".....	23	36		9	68
Colon Beach.....			45		45
Colon Hospital.....	37	10			47
Corozal.....	123	32			155
Cristobal.....	170	93	52		315
Cruces.....	1				1
Culebra.....	151	40		1	192
Culebra Island.....	9				9
Darien.....				6	6
Empire.....	160	100		2	262
Flamenco Island.....	3				3
Gatun.....	180		4	1	185
Las Cascadas.....	70	51			121
Las Sabanas.....	2				2
Marguerita Island.....	7				7
Miraflores.....	2	5			7
Monte Lirio.....	1		3		4
Naos Island.....	7				7
New Frijoles.....	2	2	1		5
Palo Seco.....	16				16
Panama.....	1	1			2
Paraiso.....	100	49			149
Pedro Miguel.....	79	11			90
Porto Bello.....	43				43
Taboga Island.....	5	4			9
Toro Point.....	50				50
Vigia.....	1				1
Total.....	1,832	567	117	19	2,535

EXHIBIT 10.—*New frame construction, fiscal year 1913-14.*

Department or division.	New structures.		Additions.		Total.	
	Number.	Cost.	Number.	Cost.	Number.	Cost.
Quartermaster's department and general use.....	5	\$15,807.10	1	\$1,187.50	6	\$16,994.60
First division.....	8	6,510.39			8	6,510.39
Second division.....	2	2,510.55			2	2,510.55
Dredging division.....	2	1,771.38			2	1,771.38
Commissary department.....	1	2,422.48	2	8,728.00	3	6,150.48
Subsistence department.....	1	726.06	2	1,515.11	3	2,241.17
Division of clubs.....			1	46.10	1	46.10
Canal Zone government.....			1	3,179.68	1	3,179.68
Terminals.....			1	1,036.26	1	1,036.26
Municipal engineering.....	1	997.34			1	997.34
Sanitary department.....	2	378.96			2	378.96
Total.....	22	31,124.26	8	10,692.65	30	41,816.91
Pedro Miguel commissary, account No. 401.....	1	8,612.22			1	8,612.22
Grand total.....	23	39,736.48	8	10,692.65	31	50,429.13

Repair work, quartermaster's department.....	\$110,872.31
Repair work, sanitary department, department of civil administration, and other divisions.....	28,154.62
Total.....	139,026.93

SUMMARY.

22 new buildings.....	31,124.26
8 additions to buildings.....	10,692.55
1 building for account No. 401.....	8,612.22
153 buildings erected from 152 which were demolished.....	284,769.02
30 buildings erected from scrap material.....	8,381.68
Repairs and maintenance of buildings.....	139,026.93
22 buildings demolished and in course of reconstruction June 30, 1914....	23,541.61
Total.....	506,148.27

EXHIBIT 11.—Buildings sold and demolished, fiscal year 1913-14.

Stations.	Buildings sold.		Build- ings de- molished.	Total sold and demol- ished.
	Number.	Amount received.		
Ancon.....			2	2
Balboa.....	1	\$115.00		1
Miraflores.....	7	427.25	21	28
Paraiso.....			3	3
Pedro Miguel.....	7	310.00	2	9
Cartagenita.....	1	35.00		1
Culebra.....	2	950.00	10	12
Empire.....			1	1
Las Cascadas.....	1	500.00		1
Mandingo.....	1	30.00		1
Bas Obispo.....			17	17
Gamboia.....	1	50.00		1
Gorgona.....	81	4,381.51	67	148
Gatun.....	1	35.00		1
Cristobal.....	4	715.00	13	17
Total.....	107	7,543.76	136	243

EXHIBIT 12. — Value of material received during the fiscal year 1913-14 on requisitions of the various departments.

Departments.	1913						1914						Total.
	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	February.	March.	April.	May.	June.	
Construction and engineering:													
Atlantic division.....	\$15,912.44	\$14,251.07	\$1,555.87	\$693.47	\$20,809.15	\$21,462.50	\$12,075.93						\$86,760.43
First division.....	345,032.71	333,602.90	179,582.42	169,451.71	201,471.33	230,659.21	228,487.18	\$374,958.95	293,120.12				2,356,366.53
Second division.....	192,107.67	30,546.30	63,897.40	51,827.68	135,644.63	94,805.01	19,899.66	35,448.79	15,526.23				639,503.37
Fourth division.....	1,154.97	535.67	1,283.64	888.03	1,383.71	1,183.26	974.28	478.34	1,128.19				9,010.09
Fifth division.....	6,135.61	35,971.48	8,163.13	6,514.09	3,864.00	46.50							60,744.81
Sixth division.....	19,238.54	11,682.75	32,308.23	27,082.73	30,079.77	38,221.74	49,614.69						208,228.45
Mechanical division.....	66,181.79	50,199.23	24,206.45	30,421.42	97,353.44	80,186.07	77,492.01	52,476.03	75,780.47	\$63,526.61	\$76,833.60	\$72,484.18	767,141.30
Fortifications.....							8,818.20	23,283.72	4,073.21	11,466.21	11,334.01	52,538.90	196,217.65
Municipal engineering.....	6,039.19	4,959.40	12,055.27	21,591.14	27,895.12	12,158.28	26,413.37	25,286.18	23,504.56	60,610.75	34,098.60	19,555.22	360,521.21
Permanent buildings.....	170.25	50.95	8,875.33	34,890.78	20,546.26	106,718.96				34,011.85	47,315.27	79,034.06	326,867.71
Dredging division.....			8,411.35	9,866.37	12,384.73	12,030.89	49,744.67	17,652.26	56,416.26	102,288.82	43,114.46	26,007.33	390,012.58
Engineer of maintenance.....								145,619.83	72,982.14	247,829.36			247,829.36
Terminal construction.....										45,766.47	41,976.20	36,114.72	123,857.39
General construction division.....										211,053.16			211,623.16
Erection division.....											250,394.98	348,087.82	628,482.80
Lighthouse division.....											719.79		719.79
Meteorology and hydrography division.....											389.15		389.15
Electrical division.....												389.91	389.91
Division of canal transportation.....												2,045.75	2,045.75
Total.....	652,023.17	481,799.75	340,339.09	352,827.42	551,432.14	597,472.42	473,519.99	675,204.10	542,536.18	776,553.23	536,746.06	636,257.89	6,616,711.44
Quartermaster's department.....	472,779.91	398,594.01	257,640.36	406,748.61	275,011.72	195,497.61	273,316.40	230,694.44	321,277.56	447,488.40	432,777.01	347,867.13	4,059,693.16
Sanitary department.....	2,353.63	4,599.06	5,010.04	13,947.18	10,978.28	3,389.85	1,752.70	1,050.38	3,801.44				46,882.56
Department of civil administration.....													
Examiner of accounts.....	355.67	880.56	1,139.08	736.59	414.96	272.10	2,314.61	417.63	98.67				6,629.87
Department of law.....	485.46		361.26		493.58	1,287.96			192.95				2,821.21
Panama Railroad Co.....	25.00						8.50		12.00				45.50
Executive secretary.....	72,340.60	27,268.75	38,665.55	29,041.23	26,193.28	15,522.10	10,535.47	21,339.89	32,126.88	20,660.18	48,249.70	23,611.34	365,554.97
Health department.....										3,306.97	1,314.54	857.05	5,478.56
Auditor's department.....										3,969.24	5,755.60	1,792.82	11,517.66
										396.92	245.45	417.80	1,060.17
Grand total.....	1,200,363.44	913,142.13	643,155.38	803,301.03	864,523.96	813,442.04	761,447.67	928,706.44	900,045.68	1,252,374.94	1,025,088.36	1,010,804.03	11,116,395.10

[illegible]

NOTE.—Atlantic division shows values from July 1, 1913, to Feb. 1, 1914; first, second, and fourth divisions from July 1, 1913, to Apr. 1, 1914; fifth division from July 1, 1913, to Jan. 1, 1914; sixth division from July 1, 1913, to Feb. 1, 1914, when it was superseded by the dredging division. The division of terminal construction, beginning Apr. 1, 1914, embraces the work and expenditures of the second division, also breakwater operations at the Atlantic terminals (formerly under the Atlantic division). The division of erection supercharges the first division and embraces the expenditures thereof, beginning Apr. 1, 1914, with the exception of the electrical and lighthouse divisions, charges for which were formerly charged against first division.

EXHIBIT 13.—*Freight statement, fiscal year 1913-14.*

Steamship lines.	Number of steamers.	General cargo, weight, pounds.	Lumber, feet b. m.	Ties.		Piling, pieces.	Total weight.	
				Pieces.	Feet b.m.		Pounds.	Tons.
Panama R. R. Co.....	76	217, 172, 000	86, 107	.....	.....	.....	217, 516, 428	108, 758
Royal Mail Steam Packet Co.....	5	469, 581	.....	.....	.....	.....	469, 581	235
Atlantic & Pacific Steamship Co.....	11	300, 105	23, 773, 515	1, 515	93, 279	3, 215	95, 767, 281	47, 884
Leyland Line.....	18	1, 226, 881	.....	.....	.....	.....	1, 226, 881	613
United Fruit Co. (New York).....	101	31, 740, 561	.....	.....	.....	.....	31, 740, 561	15, 870
United Fruit Co. (New Orleans).....	114	27, 823, 248	5, 263, 135	10, 066	545, 388	5, 909	51, 057, 340	25, 529
United Fruit Co. (Boston).....	8	29, 412	.....	.....	.....	.....	29, 412	15
Hamburg-American.....	50	6, 175, 546	.....	.....	.....	.....	6, 175, 546	3, 088
Tramps, Atlantic.....	63	2 83, 923, 985	6, 691, 088	54, 315	2, 524, 902	10, 124	120, 787, 945	60, 394
Tramps, Pacific.....	16	1, 294, 041	436, 125	.....	.....	550	3, 038, 541	1, 519
Pacific Mail.....	13	202, 143	493, 988	.....	.....	.....	2, 178, 095	1, 089
Seeborg Steamship Line	5	3, 595, 026	608, 287	.....	.....	596	6, 028, 174	3, 014
Total.....	480	373, 952, 529	37, 352, 245	65, 896	3, 163, 569	20, 394	536, 015, 785	268, 008

¹ Includes 183,073,200 pounds of cement, equal to 457,683 barrels.

² Includes 40,030,000 pounds of cement, equal to 100,075 barrels.

³ Includes 223,103,200 pounds of cement, equal to 557,758 barrels.

NOTE.—The total weight of 536,015,785 pounds given above does not include the weight of piling. Weight of piling, approximately, 18,500 net tons.

EXHIBIT 14.—*Important items due on United States requisitions, June 30, 1914.*

Articles.	Quantity.	Value.
Bascule Bridge over French Canal.....	.....	\$55, 674. 00
Caisson, lock entrance, floating.....	.....	334, 611. 20
Cable, Trans-Isthmian Line.....	.....	474, 338. 82
Colliers, coal carrying.....	2	1, 975, 000. 00
Compressor equipment, air, Balboa shops.....	.....	47, 105. 50
Cranes, electric floating (partially delivered).....	2	837, 500. 00
Locomotives, electric towing.....	19	248, 748. 00
Lumber..... feet b. m.	15, 473, 296	384, 975. 60
Marble for Balboa Dry Dock.....	.....	22, 895. 20
Movable metal louvers for Balboa shop buildings.....	.....	54, 500. 00
Material for oil-handling plants, Atlantic and Pacific.....	.....	60, 000. 00
Plants, coal handling, material for.....	2	1, 833, 128. 00
Steel:		
Forms for Balboa and Cristobal coaling plants (estimated).....	.....	86, 000. 00
Cylinders, Pier No. 7, Cristobal.....	.....	73, 777. 33
Quay walls, Balboa terminal docks.....	.....	58, 800. 00
Pipe line, Gamboa to Miraflores, material for (estimated).....	.....	250, 000. 00
Piling..... pieces..	5, 320	146, 528. 50
Ties, cross.....	15, 000	15, 394. 00
Tugs.....	2	304, 000. 00
Vaults, steel, for administration building.....	3	16, 085. 00

EXHIBIT 15.—*Important items of material purchased from inception of canal work, 1904 to June 30, 1914.*

Articles.	Quantity.	Value.
Barges.....	50	\$1, 458, 830. 00
Boats, tugs, including two not yet received.....	11	870, 734. 00
Brick, building, fire, and paving.....	.....	353, 823. 84
Cableways.....	7	365, 050. 90
Cars.....	4, 181	4, 655, 355. 79
Cement..... barrels..	6, 355, 668	6, 393, 187. 94
Compressors, air.....	28	125, 504. 77
Cranes.....	111	324, 644. 81
Electric floating (not yet received, \$423,750 each).....	2	847, 500. 00
Dredges.....	16	2, 809, 120. 00
Drills, rock.....	725	288, 376. 59
Drivers, pile.....	5	40, 966. 00

EXHIBIT 15.—*Important items of material purchased from inception of canal work, 1904 to June 30, 1914—Continued.*

Articles.	Quantity.	Value.
Explosives:		
Dynamite.....pounds..	59,560,989	\$7,126,716.46
Other blasting supplies.....		668,021.13
Forage and corral supplies.....		909,275.60
Furniture:		
Married quarters.....		271,025.74
Bachelor quarters.....		147,143.50
Hospital quarters.....		76,666.65
Laborers' quarters.....		208,809.00
		703,644.89
Live stock:		
Horses.....		39,212.50
Mules.....		131,939.44
Cows.....		10,650.00
		181,801.94
Locomotives:		
Steam.....	189	1,942,502.00
Electric towing.....	21	274,932.00
Lumber.....feet b. m..	268,774,799	6,696,892.84
Material for locks.....		14,315,394.65
Piling.....pieces..	173,507	2,285,768.05
Plants:		
Gatun hydroelectric station, building and equipment.....		366,657.43
Power (3).....		366,523.97
Material handling (3).....		689,358.60
Rock crusher (4).....		200,164.68
Filtration (5).....		168,754.11
Pumping (3).....		61,513.73
Boiler (2).....		114,961.00
Hydraulic dredging (1).....		192,868.00
Steel foundry (1).....		458,831.39
		2,619,632.91
Rails, steel.....	63,229	1,979,901.45
Roofing, corrugated iron.....		513,518.56
Screening, wire.....		430,670.94
Shovels, steam.....	102	1,094,879.96
Spreaders, earth.....	26	139,687.00
Ties, cross and switch.....	2,306.767	1,979,311.06
Unloaders.....	29	158,839.00

EXHIBIT 16.—*Important items of material received, July 1, 1913, to June 30, 1914.*

Articles.	Quantity.	Value.
Administration building, not including steel or lumber.....		\$119,805.98
Balboa Dry Dock, including gate leaves and miter forcing machinery.....		119,444.70
Balboa shops:		
Construction material, not including steel and lumber.....		256,390.56
Equipment only.....		189,499.64
Balboa terminals, not including steel and piling.....		41,245.42
Balboa town site.....		27,893.61
Barges, including cost of delivery and supplies ordered for them.....	6	410,096.28
Boats and launches, other than barges and dredges.....		47,913.17
Cement.....barrels..	557,758	513,137.36
Colon breakwater, not including piling.....		23,366.48
Colon waterworks.....		15,345.15
Cristobal coaling plant, not including steel or piling.....		25,340.66
Dredges Gamboa and Paraiso, including towing, etc.....		573,287.40
Duct line, trans-Isthmian.....		65,071.49
Dynamite.....pounds..	3,340,000	386,483.00
Other blasting supplies.....		7,480.05
Fortifications, not including steel and lumber.....		172,249.61
Forage and corral supplies.....		125,833.55
Foundry supplies.....		46,719.78
Grader equipment.....		18,015.12
Gold Hill sluicing plant.....		13,503.00
Hotel Washington, equipment and decoration.....		16,003.83
Lumber.....feet b. m..	37,352,245	1,045,862.86

EXHIBIT 16.—*Important items of material received, July 1, 1913, to June 30, 1914—*
Continued.

Articles.	Quantity.	Value.
Material for locks and lock work:		
Apparatus for control of all locks.....		\$94,034.31
Auxiliary electrical equipment for Gatun hydroelectric station.....		33,722.06
Cable.....		169,932.52
Control houses, not including structural steel.....		7,878.18
Emergency dams.....		287,313.99
Frames and covers for decking of lock walls.....		466.87
Machinery for upper guard valves.....		18,581.94
Material for chain fenders for all locks.....		482,690.38
Motors, centrifugal pumps, etc.....		49,738.00
Locomotives, electric towing (21).....		277,880.78
Plant and material, exclusive of electrical material, Gatun hydroelectric station.....		25,271.82
Spare parts for mitre gate moving machines.....		1,936.33
Transformer room equipment for all locks.....		15,478.80
Miscellaneous material for all locks.....		68,073.24
		1,532,999.22
Material for lighting and buoying the canal.....		41,544.49
Municipal engineering, not including Colon and Panama waterworks.....		40,843.21
Oils and greases.....		115,436.26
Permanent quarters for employees, not including steel, lumber, or cement.....		99,629.35
Piling.....pieces.....	20,394	422,489.23
Panama waterworks, not including structural steel.....		219,777.53
Steel:		
Flat, round, square, tool, etc.....		130,566.62
Reinforcing.....		219,805.69
Steel, structural:		
Administration building, balance erected during fiscal year.....		2,126.99
Balboa shop buildings, includes erection.....		49,116.89
Balboa terminals.....		50,598.30
Control houses, locks.....		13,671.88
Cristobal coaling plant.....		60,689.06
Cristobal terminal docks.....		87,838.11
All locks.....		9,147.78
Panama waterworks.....		11,245.07
Gamboa bridge.....		9,026.51
Substations, includes partial erection.....		129,708.96
		423,169.55
Substations, not including structural steel or equipment.....		54,973.94
Transmission line material.....		732,229.15

EXHIBIT 17.—*Classification of material in stock at storehouses June 30, 1914.*

Class number.	Description.	Amount.
1 A	New York air brake material.....	\$12,359.58
1 B	Westinghouse air brake material.....	35,925.49
2	Mechanical appliances for locomotives and boilers.....	96,587.00
3	Locomotive repair parts.....	74,189.41
4	Car repair parts.....	208,851.35
4 A	Wheels, all kinds.....	31.65
5	Equipment parts.....	2,757.93
5 A	Lidgerwood unloader repair parts.....	11,549.66
5 B	Spreader repair parts.....	3,228.85
5 C	Pile driver repair parts.....	1,813.32
5 D	Track shifter repair parts.....	220.88
5 E	Motor car repair parts.....	10,460.76
6	Steam shovel repair parts.....	372,123.52
7 A	Locomotive crane parts.....	24,885.75
7 B	Cantilever and Brown hoist parts.....	9,771.64
7 C	Handling plant parts.....	46,989.93
8 A	Rock channeler repair parts.....	3,243.65
8 B	Well drill repair parts.....	23,955.78
8 C	Rock drill repair parts.....	22,708.23
8 D	Drill sharpener repair parts.....	554.73
8 E	Mowing machine repair parts.....	1,004.26
9 A	Power driven shop machines and parts.....	98,552.67
9 B	Pneumatic and electric hand tools.....	18,166.41
9 C	Hand tools.....	68,474.83
9 D	Surveying instruments.....	8,212.29
10 A	Tug boat repair parts.....	13,489.00
10 B	Suction dredge repair parts.....	121,470.44
10 C	Ladder dredge repair parts.....	102,547.57

EXHIBIT 17.—*Classification of material in stock at storehouses June 30, 1914—Continued.*

Class number.	Description.	Amount.
10 D	Dipper dredge repair parts.....	\$71,838.04
10 E	Clapet repair parts.....	2,701.93
10 F	Barge repair parts.....	14,766.37
10 G	Marine hardware and equipment.....	7,423.83
11 A	Electric lighting material for buildings, etc.....	95,582.94
11 B	Electric material for locomotives.....	624.12
11 C	Electric material for power plants.....	193,592.98
11 D	Telephone, telegraph, and signal material.....	33,782.35
12 A	Dynamite and powder.....	59,453.97
12 B	Caps and fuses.....	3,212.49
12 C	Blasting batteries, galvanometers, and repair parts.....	1,277.73
13	Foundry supplies.....	57,676.77
14 A	Iron castings.....	57,103.52
14 B	Steel castings.....	18,222.45
14 C	Brass castings.....	49,444.07
15	Stationery and printing equipment.....	50,535.02
16	Hotel equipment and supplies.....	48,054.33
17	Corral equipment and supplies.....	16,104.98
18 A	Track material, rail, frogs, etc.....	12,960.89
18 B	Track fastenings.....	32,572.11
18 C	Track tools.....	22,790.23
19	Building material.....	31,529.10
20	Lumber, piling, and ties.....	112,032.10
21	Steel and iron.....	377,432.10
22	Pipe, all kinds, except brass, copper, cast iron, water, and sewer.....	112,628.84
23	Plumbers supplies and pipe fittings.....	235,543.16
24	Metals, brass and copper pipe.....	88,167.65
25	Bolts, nuts, rivets, etc.....	96,715.89
26	Hardware.....	137,701.09
27	Rubber and leather goods.....	210,652.00
28	Cleansing material, paints, oils, drugs, etc.....	127,934.76
29	Empty oil drums.....	105.52
29 A	Lubricants and containers.....	26,103.97
29 B	Illuminants, compounds, waste, etc.....	31,203.34
30	Fuel.....	19,065.16
32 A	Scrap, copper, brass, etc.....	5,575.53
32 B	Scrap, all kinds not included in 32 A.....	17,556.45
	Total.....	3,873,804.46
	Balboa dry dock material.....	108,865.89
	Lock gate parts.....	4,811.16

EXHIBIT 18.—*Value of stock on hand at storehouses June 30, 1914.*

Mount Hope.....	\$2,059,342.91
Gatun.....	35,911.29
Empire.....	283,304.81
Paraiso.....	325,076.69
Corozal.....	114,516.12
Ancon.....	8,044.71
Balboa.....	1,161,284.98
Total.....	3,987,481.51

EXHIBIT 19.—*Rolling stock, July 1, 1914.*

	For sale.	For sale as scrap.	Scraped or wrecked.	Sold.	Re-serve.	In use.	Total.
Steel flat cars.....			2	1	1	496	500
Lidgerwood flat cars.....	43	84	184	115	21	1,459	1,806
12-yard Oliver dump cars.....	131	7	13	55		394	600
12-yard Western dump cars.....	181	20	5			394	600
18-yard Oliver dump cars.....	13		2			285	300
18-yard Western dump cars.....	58		6			236	300
Goodwin dump cars.....	12						12
Ingoldsby dump cars.....	1					11	12
King Lawson dump car.....						1	1

Panama R. R.

EXHIBIT 19.—*Rolling stock, July 1, 1914—Continued.*

	For sale.	For sale as scrap.	Scrap- ped or wreck- ed.	Sold.	Re- serve.	In use.	Total.
Locomotives, under 100 class.....	2	2	22	1			27
101 class.....	24						24
201 class.....	18	1	2		1	78	100
301 class.....	33					7	40
401 class.....	3		1			2	6
451 class.....		8	1	1		9	22
501 class.....	2	25	4	3		9	43
601 class.....					15	5	20
701 class.....		6	16	21		10	53
801 class (36-inch).....	5			12		6	23
871 class (42-inch).....				10			10
Decauville.....	2		1	2		4	9
Electric (36-inch).....	5	3		4			12
Cranes, railroad.....	3	2	14	3		61	83
Steam shovels:							
Thew No. 21.....	1						1
20 Marion.....				1			1
60 Marion.....				7			7
91 Marion.....	5		2	3		6	16
45 Bucyrus.....	3			7			10
70 Bucyrus.....	21	1	1	1	2	9	35
95 Bucyrus.....	19	1	1	5	6	5	32
Spreaders.....	12					14	26
Track shifters.....	1		1			8	10
Pile drivers.....	4		9	1		10	24
Unloaders.....	10		1	4		15	30
Motor cars.....	1		1			6	8
Automatic railway cars (24-inch).....	45						45
36-inch gauge flats.....	65	2				14	81
36-inch gauge dumps.....	38					4	42
42-inch gauge flats.....				20			20
42-inch gauge dumps.....			18	57			75
Total.....	761	162	307	237	46	3,558	5,071

¹ Panama R. R.EXHIBIT 20.—*Important items of equipment sold.*

Articles.	Quantity	Sale price.
Cars:		
Dump, 12-yard, 5-foot gauge.....	55	\$33,065.00
Dump, narrow gauge, 42 inches.....	41	3,280.00
Flat, steel, 5-foot gauge.....	1	625.00
Cranes, 5-foot gauge.....	2	6,300.00
Crushers, rock.....	5	14,350.00
Drills, star well.....	11	2,800.00
Driver, pile, 5-foot gauge.....	1	300.00
Floating equipment:		
Barges No. 18, No. 23, and "Walter Reed".....	3	850.00
Clapet No. 5.....	1	100.00
Dredge Mole.....	1	2,500.00
Launch "La Zona," hull only.....	1	127.50
Tugboat "Exotic".....	1	1,350.00
Locomotives, narrow gauge.....	25	18,240.00
Machines, shop:		
Blower.....	1	12.50
Boring.....	1	350.00
Countersinking.....	1	75.00
Cutters, bolt.....	2	200.00
Wheel, emery.....	1	10.00
Fan, blast.....	1	4.00
Grinders.....	5	110.00
Hammers, power.....	2	300.00
Lathes.....	17	1,950.00
Pipe cutting.....	1	20.00
Planer.....	1	300.00
Presses, drill and wheel.....	7	400.00
Punch and shear.....	2	215.00
Road.....	1	10.00
Roll, bending.....	1	10.00
Shaper.....	2	175.00
Saws.....	4	109.50
Threading.....	2	27.00
Shovels, steam, 5-foot gauge.....	18	31,875.00
Unloaders, 5-foot gauge.....	4	2,300.00
Total.....		122,340.50

EXHIBIT 21.—*Pending sales of important items of equipment June 30, 1914.*

Articles.	Quantity.	Value.
Cars:		
Dump, 4-yard 36-inch gauge.....	15	\$2,250
Dump, 12-yard.....	20	6,020
Dump, Goodwin.....	12	6,500
Crane, No. 48.....	1	4,100
Total.....		18,870

Pending sales of scrap shipped to the United States.

Articles.	Quantity.	Articles.	Quantity.
	<i>Pounds.</i>		<i>Pounds.</i>
Bearings, brass.....	15,000	Rope.....	31,502
Castings, brass.....	13,000	Tubes, condenser, brass.....	40,500
Copper, heavy.....	3,000	Wire, copper.....	18,000
Copper, sheet.....	42,500		

EXHIBIT 22.—*Statement of rail sold.*

	Gross tons.		Gross tons.
Central Railway of Ecuador.....	603	United Fruit Co.....	1,977
Chile Exploration Co.....	770	Venezuelan Government.....	200
R. W. Hebard & Co.....	46	Miscellaneous.....	43
Pacific Steam Navigation Co.....	76		
Republic of Panama.....	43	Total.....	3,758

EXHIBIT 23.—Operation of Hotel Tivoli, July 1, 1913, to June 30, 1914.

Year and month.	Supplies consumed.	Laundry.	Pay roll.		Miscellaneous.	Fuel.	Light.	Equipment.	
			General force.	Gold and silver.				Straight.	Expendable.
1913.									
July.....	\$7,079.75	\$95.49	\$155.17	\$3,181.33	\$533.48	\$269.67	\$110.49	\$421.49	\$210.32
August.....	8,612.19	500.00	268.07	3,708.11	113.36	198.18	193.34	370.01	161.99
September.....	7,705.76	500.00	198.16	4,026.64	160.25	127.09	299.72	587.46	151.21
October.....	8,700.50	500.00	299.61	3,954.36	258.11	479.84	317.08	221.89	454.65
November.....	7,561.46	500.00	242.25	4,029.61	212.51	313.07	227.85	5,353.65	119.22
December.....	7,657.65	500.00	162.27	4,717.02	125.81	261.36	282.79	490.85	138.29
1914.									
January.....	8,004.84	593.86	216.94	4,109.50	115.89	361.47	221.48	545.27	210.78
February.....	8,768.86	500.00	355.24	4,247.78	114.17	88.80	244.75	294.43	221.96
March.....	8,853.36	500.00	335.08	4,240.47	151.87	363.07	270.39	166.88	40.79
April.....	7,743.22	500.00	132.18	3,841.54	29.58	165.83	247.65	43.92	52.78
May.....	7,006.61	500.00	142.30	3,308.31	122.73	456.59	272.45	74.81	30.06
June.....	6,348.42	516.60	257.80	3,134.09	101.97	268.52	262.48	81.93	63.66
Total.....	94,042.02	5,705.95	2,765.07	46,498.76	1,835.79	3,353.49	2,950.47	8,652.59	1,855.71
1913.									
July.....	\$12,057.19	\$13,329.70	\$486.60	\$253.28	\$1,299.35	\$15,268.93	\$3,211.74		10,866
August.....	14,125.25	18,139.29	506.70	171.02	930.15	19,747.16	5,621.91		13,862
September.....	13,756.29	14,880.81	741.60	197.91	12,216.39	13,603.93		\$152.36	10,451
October.....	15,186.04	15,695.53	476.40	195.38	1,734.94	18,102.25	2,916.21		12,458
November.....	18,559.62	13,945.04	384.00	513.51	1,181.85	14,660.70		3,898.92	10,929
December.....	14,336.04	12,995.14	381.00	24.80	1,860.10	12,540.84		1,795.20	9,839
1914.									
January.....	14,380.03	14,683.61	224.70	6.75	1,499.65	16,414.71	2,034.68		11,880
February.....	14,835.99	20,270.11	503.40	12.50	441.55	21,227.56	6,391.57		14,760
March.....	14,921.91	19,043.52	418.50	2.00	371.85	19,835.87	4,913.96		14,161
April.....	12,756.70	14,923.52	343.50		1,957.15	14,309.87	1,553.17		10,636
May.....	11,913.86	12,521.51	325.50	262.15	1,418.00	12,691.16	777.30		9,130
June.....	10,831.63	11,041.32	298.50	288.15	1,099.25	10,528.72		302.81	7,845
Total.....	167,660.45	181,369.10	5,090.40	1,927.45	544.75	188,931.70	21,271.25		136,817
1913.									
July.....	\$12,057.19	\$13,329.70	\$486.60	\$253.28	\$1,299.35	\$15,268.93	\$3,211.74		10,866
August.....	14,125.25	18,139.29	506.70	171.02	930.15	19,747.16	5,621.91		13,862
September.....	13,756.29	14,880.81	741.60	197.91	12,216.39	13,603.93		\$152.36	10,451
October.....	15,186.04	15,695.53	476.40	195.38	1,734.94	18,102.25	2,916.21		12,458
November.....	18,559.62	13,945.04	384.00	513.51	1,181.85	14,660.70		3,898.92	10,929
December.....	14,336.04	12,995.14	381.00	24.80	1,860.10	12,540.84		1,795.20	9,839
1914.									
January.....	14,380.03	14,683.61	224.70	6.75	1,499.65	16,414.71	2,034.68		11,880
February.....	14,835.99	20,270.11	503.40	12.50	441.55	21,227.56	6,391.57		14,760
March.....	14,921.91	19,043.52	418.50	2.00	371.85	19,835.87	4,913.96		14,161
April.....	12,756.70	14,923.52	343.50		1,957.15	14,309.87	1,553.17		10,636
May.....	11,913.86	12,521.51	325.50	262.15	1,418.00	12,691.16	777.30		9,130
June.....	10,831.63	11,041.32	298.50	288.15	1,099.25	10,528.72		302.81	7,845
Total.....	167,660.45	181,369.10	5,090.40	1,927.45	544.75	188,931.70	21,271.25		136,817

¹ Credit. This amount is preceding month's excess over current month.² Credit. This amount in excess overcharges to miscellaneous.

EXHIBIT 24.—*Summary of operations, July 1, 1913, to June 30, 1914.*
LINE HOTELS AND RESTAURANTS.

Year and month.	Supplies consumed.	Laundry.	Pay roll.		Miscellaneous.	Fuel.	Light.	Equipment.	
			General force.	Line gold and silver.				Straight.	Expendable.
1913.									
July.....	\$54,294.58	\$1,812.08	\$1,489.42	\$8,531.31	\$614.35				
August.....	51,908.27	1,726.17	1,196.71	8,147.54	470.32				
September.....	47,500.08	1,609.67	1,241.62	7,707.56	667.34				
October.....	45,581.01	1,661.74	1,406.37	7,293.96	493.12				
November.....	43,898.38	1,297.43	1,298.65	7,460.52	581.26				
December.....	44,556.63	1,406.48	1,111.80	6,987.25	581.42				
1914.									
January.....	43,923.85	1,312.32	1,440.88	7,002.12	222.37				
February.....	40,218.94	1,227.68	1,246.40	7,228.80	830.38				
March.....	44,416.42	1,356.36	1,473.14	7,247.91	682.37				
April.....	42,771.33	1,207.66	1,523.37	7,035.02	803.81				
May.....	44,075.22	1,256.96	653.80	6,625.23	623.17				
June.....	40,127.65	1,290.01	1,411.18	6,811.85	578.82				
Total.....	543,272.36	17,164.56	14,493.34	88,079.07	7,148.73				
1913.									
July.....	\$66,741.74	\$1,611.55	\$62,334.00	\$324.70	\$64,270.25		\$2,471.49	208,209	
August.....	63,449.01	1,120.45	60,696.00	257.33	62,073.78		1,375.23	201,999	
September.....	58,726.27	1,049.20	55,722.00	277.26	57,048.46		1,677.81	186,002	
October.....	56,436.20	1,120.48	53,448.50	270.82	54,839.80		1,596.40	178,798	
November.....	54,536.24	1,166.20	50,375.00	395.12	51,936.32		2,599.92	168,994	
December.....	54,643.58	1,198.53	51,055.20	448.62	52,702.35		1,941.23	172,923	
1914.									
January.....	53,801.54	1,211.61	50,570.10	\$118.55	52,520.93		1,380.61	174,677	
February.....	50,752.20	1,554.63	46,432.20	187.05	48,573.42		2,178.78	160,078	
March.....	55,176.20	2,047.03	50,935.20	13.25	53,455.26		1,720.94	175,541	
April.....	52,841.19	1,288.75	49,284.65	87.75	51,157.85		1,183.34	169,027	
May.....	53,234.38	1,690.69	50,821.15	174.75	52,983.65		250.73	174,521	
June.....	50,219.51	1,041.13	48,781.65	128.25	50,229.81	\$10.30		166,708	
Total.....	670,158.06	16,300.25	630,455.65	13.00	651,791.88		18,366.18	2,137,477	

¹ Credit. This amount preceding month's excess over current month.

EXHIBIT 24.—*Summary of operations, July 1, 1913, to June 30, 1914—Continued.*
EUROPEAN LABORERS' MESES.

Year and month.	Supplies consumed.	Laundry.	Pay roll.		Miscellaneous.	Fuel.	Light.	Equipment.		
			General force.	Line gold and silver.				Straight.	Expendable.	
1913.										
July.....	\$33,137.89	\$147.53	\$963.50	\$3,454.17	\$315.28	\$591.99	\$53.90	\$280.14	\$60.65	
August.....	33,557.35	143.50	820.24	3,530.22	229.59	591.99	53.90	422.00	86.12	
September.....	32,024.94	131.24	891.76	3,409.32	347.80	591.99	53.90	60.71	87.20	
October.....	29,757.05	127.24	983.40	3,207.63	229.72	591.99	49.70	217.67	74.79	
November.....	24,369.59	123.72	784.52	3,033.80	281.41	591.99	49.70	89.87	61.91	
December.....	22,890.10	145.54	616.46	2,621.86	273.24	591.99	49.70	108.28	60.31	
1914.										
January.....	21,906.30	150.33	790.95	2,346.74	270.50	591.99	49.70	.....	49.48	
February.....	19,134.86	133.98	625.92	2,381.34	262.10	591.99	49.70	3.87	52.99	
March.....	21,167.75	138.41	747.77	2,324.29	262.15	.....	49.70	.....	39.64	
April.....	20,009.37	134.29	261.76	2,179.74	217.22	414.57	48.70	4.40	36.76	
May.....	20,150.96	131.42	323.48	2,154.72	289.95	327.62	46.70	46.30	9.84	
June.....	19,303.73	152.58	700.62	1,912.19	223.45	329.13	43.50	62.58	40.13	
Total.....	257,409.89	1,659.78	8,510.38	32,556.02	3,202.41	5,807.94	596.80	1,295.82	659.82	
Grand total.....	740,682.25	18,824.34	23,003.72	110,635.09	10,451.14	5,807.94	596.80	1,295.82	659.82	
Year and month.										
Year and month.	Total cost of operations.	Cash.	Coupons and tickets.	Accounts.	Collections.	Total revenue.	Profit.	Loss.	Meals served.	Rations served.
1913.										
July.....	\$39,005.05	.....	\$40,540.24	.....	\$1,030.24	\$41,570.48	\$2,565.43	.....	.....	103,926
August.....	39,434.91	.....	41,532.35	.....	1,003.49	42,535.84	3,100.93	.....	.....	106,340
September.....	37,598.86	.....	40,007.58	.....	988.02	40,995.60	3,396.74	.....	.....	102,489
October.....	35,239.19	.....	37,225.50	.....	1,076.64	38,302.14	3,062.95	.....	.....	95,755
November.....	29,386.51	.....	30,386.07	.....	995.47	31,381.54	1,995.03	.....	.....	78,454
December.....	27,357.48	.....	28,265.74	.....	1,007.89	29,273.63	1,916.15	.....	.....	73,184
1914.										
January.....	26,155.99	.....	26,871.98	.....	1,195.60	28,067.58	1,911.59	.....	.....	70,169
February.....	23,236.75	.....	23,322.96	.....	1,086.37	24,409.33	1,172.58	.....	.....	61,023
March.....	24,729.71	.....	26,092.34	.....	1,068.45	27,160.79	2,431.08	.....	.....	67,902
April.....	23,304.81	.....	24,588.61	.....	962.96	25,551.57	2,246.76	.....	.....	63,879
May.....	23,480.99	.....	24,959.49	.....	1,283.84	26,243.33	2,762.34	.....	.....	65,608
June.....	22,768.61	.....	23,622.11	.....	1,283.69	24,905.80	2,137.19	.....	.....	62,265
Total.....	351,698.86	.....	367,414.97	.....	12,922.66	380,397.63	28,698.77	.....	.....	950,994
Grand total.....	1,021,856.92	\$16,300.25	997,870.62	\$13.00	18,005.64	1,032,189.51	10,332.59	.....	2,137,477	950,994

APPENDIX TO APPENDIX F.

REPORT OF THE RESIDENT ENGINEER, PERMANENT BUILDING DIVISION, SUPPLY DEPARTMENT, SEPT. 13 TO JUNE 30, 1914.

Following the selection of the town site at Balboa and the laying of foundations for the new administration building by the fifth division, as stated in the annual report for 1913, the work of completing the design and construction of the permanent buildings was transferred to the quartermaster's department, effective August 1, 1913, and placed in charge of Mr. Frank Holmes, resident engineer, with Mr. Mario J. Schiavoni as architect. Mr. Schiavoni resigned, effective December 5, 1913, and was succeeded by Mr. Samuel M. Hitt as architect.

As the work progressed it was divided into two districts. Mr. Frank J. Carew was appointed superintendent of the northern district and began work on August 26, 1913. He was later transferred to the southern district on March 1, 1914, and Mr. Hugh P. Oram was appointed and given charge of the northern district on that date.

Effective December 1, 1913, the permanent building work and the work of reerection and maintenance of buildings were consolidated, and Mr. Charles B. Cook, formerly in charge of reerection, was appointed as assistant to the resident engineer.

Buildings under construction on June 30, 1914:

Northern district:

- Hydroelectric station, Gatun.
- Two transmission line substations, Cristobal and Gatun.
- Commissary warehouse, Cristobal.
- Radio station buildings, Colon and Darien.

Southern district:

- Administration building, Balboa.
- Two transmission line substations, Miraflores and Balboa.
- Permanent quarters, Balboa (twenty-eight 4-family and nine 2-family quarters).
- Shops office, building No. 28, Balboa.
- Fire station, Balboa.
- Commissary building, Balboa.
- Schoolhouse, Balboa.
- Radio station, Balboa.
- Commissary building, Ancon.

It was decided to construct the walls and partitions of the permanent administration building, the permanent quarters, the shops office building, and the substations of hollow concrete blocks or tile similar in form to the clay product of the fireproofing companies. To accomplish this 12 machines were purchased from Mr. A. A. Pauly under his patent for machines to manufacture concrete blocks by steam process.

One of the machines produces blocks 3 by 12 by 12 inches.

Two of the machines produce blocks 4 by 12 by 12 inches.

One of the machines produces blocks 6 by 12 by 12 inches.

Four of the machines produce blocks 8 by 12 by 12 inches.

Two of the machines produce blocks 8 by 16 by 12 inches.

Two of the machines produce blocks 12 by 18 by 12 inches.

The last dimension, or height, is variable up to 12 inches.

These machines were installed in a reerected section of the Cocoli cement shed at Corozal, and began the manufacture of blocks on November 10, 1913. Since that date the following number of blocks have been manufactured at a cost for labor and material shown in the following table. The labor cost is an average of \$0.034 per block, the variation shown being due to the difference in amount of material required for the respective sizes:

Size of blocks.	Number manufac- tured.	Cost for labor and material.
3 by 12 by 12 inches	85,622	\$0.057
4 by 12 by 12 inches	162,101	.060
6 by 12 by 12 inches	90,067	.073
8 by 12 by 12 inches	247,766	.088
8 by 16 by 12 inches	106,191	.098
12 by 18 by 12 inches	77,925	.119
Total	769,672	.....

The average daily force employed on this work was 3 gold and 64 silver men.

ADMINISTRATION BUILDING.

The plan of this building has the form of an E, the main building being 326 feet 8 inches front by 55 feet 8 inches wide, with two wings each 122 feet 7 inches long by 55 feet 8 inches wide, and a center wing or stair hall 32 feet 6 inches long by 43 feet wide, all having a height of 60 feet above the first-floor level, with a basement covering the entire area of the building, the floor of same being 9 feet 6 inches below the first-floor grade. Foundations have been installed in the southwest corner of this basement for two seismographs.

The building is constructed as follows: Mass concrete foundations resting on a bed of decomposed rhyolite, steel skeleton, reinforced stone concrete floor arches 4 inches thick, and reinforced sawdust concrete roof arches of the same thickness. All stairs throughout are of reinforced concrete construction.

The curtain walls, as before stated, are of concrete blocks, and the spandrels of poured concrete; the roof cover is hard-burned clay tile, dark red in color, and of the Spanish S pattern, fastened to the sawdust concrete slab with hardened copper nails.

Floors throughout the office portion are of edge-grained yellow pine, fastened to redwood sleepers embedded in cinder concrete. Floors of corridors and porches are of red Ruabon quarry tile, 6 by 6 inches, with marble mosaic floors throughout the rotunda and main stair hall.

The walls and ceilings are lime plastered, except the walls of the rotunda and main stair hall and the wainscot of the corridors and board room, which are of white cement plaster. All exterior wall surfaces are plastered in cement stucco, float finished.

The doors, frames, sash, and trim throughout are of solid mahogany, with solid brass hardware.

The rotunda is furnished with eight ornamental columns of Pavanazzo marble and Verde antique base. The main stairs are covered with pink Tennessee marble treads and risers with strings same as rotunda base.

The toilet rooms are finished with white tile wainscot and floor, and pink Tennessee marble partitions.

Three fire and burglar proof vaults are contracted for, and several fireproof book vaults have been constructed. The building is equipped with a passenger elevator of 2,500 pounds' capacity at a speed of 125 feet per minute, vacuum cleaner system connected to a vacuum pump of six-sweeper capacity, a complete system of fire lines, with risers and outlets on each floor, all outlets having 75 feet of 2½-inch linen hose attached; also automatic fire-alarm system and watchmen's clocks, and a system of self-winding clocks; and is furnished with a mail chute.

As stated in the report of 1913, steel erection began on June 18, 1913. Said erection was completed by the United States Steel Products Co. on October 5. The construction of walls and floor arches was immediately begun. The exterior walls, interior partitions, and floor arches were completely constructed by May 15. Plastering work was commenced on March 15, and on June 30 the plaster and stucco work was 90 per cent complete.

As rapidly as the mahogany trim arrived it was varnished and set in place. On June 30, 80 per cent of the windows and doors of the exterior walls, including the screens, were in place and finished. The trim for the interior partitions is not yet delivered. Installation of wood floors was begun late in May, and on June 30 this work was 90 per cent complete.

The rough plumbing was completed by May 15 and approximately 30 per cent of the finished plumbing work was complete on June 30. The roofing work is entirely complete. The setting of marble in the rotunda began on June 29.

On June 25 the space for the timekeeping office on the first floor was ready for occupancy.

PERMANENT QUARTERS.

These buildings are constructed with reinforced concrete foundations, reinforced concrete floor slabs, concrete block walls and partitions, and framed roof structure of yellow pine, sheathed with the same material and covered with dark red clay tile, the same as used on the administration building roof. The floors are of yellow pine, except the porches and bathrooms, which are cement finished. The doors, frames, sash, and trim are of cypress, with painted exterior and varnished interior finish. Solid brass hardware is used throughout.

All exterior walls are plastered with cement stucco, float finished, and all interior walls with lime plaster.

The four-family quarters are 90 feet front by 36 feet deep, and two stories in height, with an open basement, having 6 feet 6 inches clear headroom. Each apartment contains two bedrooms, a living room, dining room, kitchen, dry room, and bathroom; also front and rear verandas.

The two-family quarters are of similar type and construction, two stories in height, and cover an area of 53 feet front by 35 feet deep.

In December, 1913, the construction of 20 four-family quarters to be located on the lowland between Sosa and Ancon Hills and on the east toe of Sosa Hill, was authorized. Later 8 other four-family quarters were authorized and 9 two-family quarters, making a total authorization of 28 four-family and 9 two-family quarters.

Excavation for these buildings began on January 5, 1914. About May 15 the first of these houses was completed and assigned for occupancy. On June 30 a second house had been completely plastered and trimmed, and painting was in progress. The plaster work on the permanent quarters began on April 22, 1914, with a force of 20 plasterers, sufficient to cover one building at a time. This force could not be increased prior to June 30 because of the requirements at the administration building.

On June 30, 19 houses were under roof, with the tile roof cover complete on 8. All walls and partitions in the first 20 houses were complete, except around the rough plumbing, and this work was complete in 11 houses.

Of the remaining 8 four-family quarters, 5 were complete in the rough, up to and including the second-floor slab, and 3 up to and including the first floor slab. Of the 9 two-family quarters all foundation work was complete on June 30, and 3 houses were complete in the rough up to and including the first floor slab.

HYDROELECTRIC STATION POWER PLANT.

This building covers an area 61 feet front by 137 feet deep by 74 feet high, and is constructed of mass concrete foundations resting on a rock bed, with steel skeleton and poured concrete walls and partitions. Floor arches are of reinforced stone concrete and the roof arch of sawdust concrete, 4 inches in thickness.

The bus and switch compartments for the electrical equipment are constructed of reinforced concrete. The walls of the turbine pit and first story, for 14 feet above the turbine pit floor, are finished in white enameled brick, English size, the floor surface being 2-inch red and buff hexagonal tile laid in pattern.

All wall surfaces, exterior and interior, were finished by rubbing the poured concrete with a cement brick.

The doors, sash, frames, and trim are of solid mahogany, except the two main doors, four bull's-eye windows, and the rail panels of the first balcony, which are of cast iron. All hardware is of solid brass.

The construction work of this building was performed by the Atlantic division up to September 8, 1913. On that date this work was assigned to the quartermaster's department. The work at that time had progressed to the completion of the structural steel work, except that portion of the roof construction which cantilevers beyond the exterior wall surfaces, and forms the overhang or eaves. These eaves project 14 feet beyond the exterior walls.

The exterior walls were completed up to the spring line of the circular window heads and the first gallery floor arches were in place at the time.

On October 27, 1913, the work of constructing the gate house was assigned to this department, as well as the spillway tunnel extension and entrance, and the finishing of the interior of the spillway tunnel, also the construction of the stairways and sidewalks at the east and west abutments of the spillway.

By the end of October the walls and floor arches of the hydroelectric station were complete and the pouring of the roof arches was in progress. During November the concrete stairways and tunnel extension were completed and the steel for the gate house was erected. The concrete work was not commenced, as the construction work on the north toe of the dam, then in progress, would not permit of same.

During December concrete work at the gate house was completed and the piers for the support of the stairways from the east abutment to the spillway channel wall were also completed, and the finished floor in the machinery tunnel of the spillway was started. The steel and concrete work of the roof and overhang of the hydroelectric station were also completed and 70 per cent of the tile roof set. The bus and instrument compartments on the first and second galleries were also completed, and the rubbing of the exterior and interior concrete surfaces of the walls was commenced.

During January this work continued, the roof being completed and the tile floors of the second gallery and toilets was begun. The rubbing of the concrete wall surfaces of the gate house and the tile roof of same were commenced and completed during this month. The finishing of the tunnel floor was also completed. During this month the roof of the hydroelectric station was finished, the concrete stairs from the east abutment to the spillway channel were completed, and the concrete sidewalk around the building was installed except for top finish.

During March the enameled brick wainscot was completed and the installation of door and window frames begun, and in May all trades were withdrawn and the building turned over for operation.

The installation of door and window frames was not complete on June 30, due to the nonarrival of hardware and the iron doors and windows mentioned. The latter arrived about June 20 and the erection of same was begun on June 27.

TRANSMISSION LINE SUBSTATIONS.

Each of these buildings occupy an area 128 feet by 74 feet, and are 70 feet in height. Each substation is constructed with reinforced concrete foundations, steel skeleton and reinforced stone concrete floor arches, the roof arches being composed of sheets of corrugated asbestos sheathing, each sheet 6 feet by 2 feet 3½ inches, bolted to the angle iron purlins with brass bolts five-sixteenth-inch diameter, the corrugations extending along the roof at right angles to the pitch. Upon this sheathing is placed 3 inches of sawdust concrete, one part cement, four parts sand, and one part sawdust, this mixture being the same as for all sawdust concrete slabs mentioned. In this instance, however, the sawdust concrete slab is not reinforced with steel, except that five-eighths-inch square reinforcing rods were placed at intervals of approximately 3 feet, and over the ridge, arranged to prevent the slab from sliding on the pitched roof.

The roof cover is of dark-red clay tile similar in pattern to those previously mentioned and fastened in the same way to the arch. The walls and partitions are of hollow concrete blocks, except the rear walls of the lightning-arrester compartments, which are poured concrete from the ridge of the roof to the first floor. The exterior surfaces of the building and the walls of the workrooms are plastered with cement stucco, float finish. The switchboard room, the stair halls, and the office and toilets are finished with white cement plaster, the floors and wainscot of the toilets being finished the same as those in the administration building. The switchboard room and stair halls on the first floor have a 5-foot wainscot of enameled brick, English size. The floors of these rooms and the office are finished with hexagonal tile, the same as described for the hydroelectric station. The doors, sash, frames, and trim are of solid mahogany, with solid brass hardware.

GATUN SUBSTATION.

This was the first substation on which actual construction began. Excavation for the foundations was begun on November 25, 1913, and during December the entire excavation and foundation walls to grade, amounting to 5,300 cubic yards of excavation and 1,396 cubic yards of concrete, were completed and the subsurface drainage system installed.

The United States Steel Products Co. began erection of the structural steel on January 5, 1914, and on February 6 the work of placing floor and wall forms for the superstructure was begun. The laying of the corrugated asbestos roof sheathing was started on March 6, and the pouring of the sawdust concrete slab on March 19. The rough plumbing work in this building was completed during March, and the exterior concrete block walls were started on March 25, as were also the instrument cabinets on the second floor. These compartments are constructed of reinforced concrete as mentioned for the hydroelectric station.

The plastering of the interior of the building was commenced on April 25. This proceeded slowly, due to the fact that only a few men could be spared for said work. The poured concrete cornice and soffit of the overhang was completed about May 1, and the asbestos sheathing and sawdust concrete roof slab were completed May 10. The setting of roof tile began on May 12. Floor and wall tiling were begun on May 25. On June 30 the exterior walls and 95 per cent of the interior partitions were completed in the rough. The enameled brick wainscot in the switchboard room and stair halls was completed, and 50 per cent of the finished trim was in place. Marble partitions in the toilets and floor and wall tiling were complete. The interior plastering was 60 per cent complete and the exterior brown coat 15 per cent complete. The roof tile and copper flashing were complete.

MIRAFLORES SUBSTATION.

This substation was the second to start actual construction, although the work on this site began on October 29, or one month prior to the Gatun substation. From October 29 to November 7

was occupied in clearing the site of débris and jungle. On November 7 excavation or grading was commenced and 15,114 cubic yards of earth and rock were removed to bring the site to the first floor grade. This material was deposited as fill on the lowlands immediately adjoining the building site.

Excavation for foundations began on December 3 and continued until January 1. On December 17 the foundation concrete work was commenced and completed on January 20. Steel erection began on January 22 and was completed on March 7. During this period a portion of the forces previously engaged on the foundation work installed boiler and turbine foundations in the Miraflores power plant, which adjoins this substation, this work being performed under request of the mechanical division.

On March 10 the placing of forms for the exterior walls and floors of the superstructure was begun, and on March 19 the placing of the asbestos sheathing commenced. The setting of concrete blocks began on April 22. The placing of forms for the roof overhang began on April 20 and all concrete had been placed in same on June 2.

The construction of the bus and instrument compartments on the second floor was commenced on May 4 and 95 per cent completed by June 30.

On that date exterior walls were 90 per cent complete and interior partitions 65 per cent complete. Enameled brickwork was 95 per cent completed; plastering 10 per cent complete; frames, sash, and trim 15 per cent complete. Tile for the floors and walls had not been commenced. The roof was 98 per cent complete.

CRISTOBAL SUBSTATION.

This substation is located in the swamp land adjoining Dock 13, the surface of the ground being so low that it was necessary to place hydraulic fill approximately 2 feet deep, of coral, to make possible the installation of a track upon which to operate a pile driver.

Borings proved that the underlying rock bed stood at an elevation of from minus 25 to minus 55. The first-floor grade of this substation was placed at plus 10, to provide for filling of the surrounding area after the completion of the substation.

Six hundred and fifty cypress piles were driven by the Panama Railroad Co.'s pile-driving crew from March 4 to March 30. As rapidly as an area was prepared, the pile butts were removed by this division to an elevation of minus 5/10, and the column footings installed. On April 4 the foundations were in readiness and steel erection was commenced. The steel structure was erected complete and 75 per cent of the riveting done during the month of April.

The forms and reinforcing for the first-floor concrete slab were also placed during April and the pouring of concrete in same commenced. This work was completed during the month of May; also the placing of the asbestos sheathing to receive the roof slab, and approximately 25 per cent of the sawdust concrete slab on same was poured.

During the month of June the forms for the roof overhang and floor arches were completed, the overhang completely poured and the asbestos sheathing and sawdust concrete roof slab completed, and 15 per cent of the roof tile set. Exterior walls were carried to the first-floor sill height and the interior partitions started; also 60 per cent of

the concrete walls behind the lightning-arrester compartments were poured complete.

The setting of bucks for the window frames was also begun, and the forms for the instrument cabinets were started and the rough plumbing completed.

The ornamental concrete castings for the pilaster caps and bases were made during this month.

BALBOA SUBSTATION.

This substation is located on the north toe of Sosa Hill, immediately south of Balboa road. To prepare the site and bring it to the first-floor grade 14,000 cubic yards of earth and rock were excavated, the work being commenced on April 28. On May 28 the foundations were complete and erection of the steel was commenced. Steel erection was completed on June 25.

During the month the exterior walls to sill height of the first floor were completed. The first-floor slab and the floor arches in the cable gallery were completed and 40 per cent of the poured concrete walls back of the lightning-arrester compartments were complete. One-third of the roof overhang was completed and 60 per cent of the asbestos roof sheathing set and covered with a sawdust concrete slab. The rough plumbing was completed.

COMMISSARY WAREHOUSE.

This building is located immediately south of the present cold-storage warehouse, which adjoins the cold-storage plant in Cristobal. It covers an area of 200 by 60 by 40 feet high, with a covered loading platform 12 feet wide along the entire length of the west side. The clearing of the site was started on April 23, 1914. This included the removal of an old storehouse of the Panama Railroad Co., and an old coaling trestle, with 900 cubic yards of earth embankment. Before the oil and coal house could be removed, a small concrete building 18 by 18 by 15 feet was constructed to provide the necessary storage for coal and oil.

Borings to determine the elevation of the rock were commenced on April 28. These borings, eight in number, show rock at an average elevation of minus 45, and also show the top of a bed of loose coral with an average thickness of 25 feet, to be at an elevation of minus 4. It was considered more economical to rest the building on the coral bed than to attempt to drive piles. Accordingly, spread foundations were designed of mass concrete to impose a uniform load of $2\frac{1}{4}$ tons per square foot on the coral bed.

The excavation for these foundations was carried to minus 5, and 1 foot of crushed stone placed in the bottom of the excavation, tamped in place before the footings were poured. Excavation for the foundations began on May 12, and developed the fact that the building site had been previously occupied by old French magazines or storehouses, as old concrete foundations, brick walls, steel tanks, machinery beds, old rails, etc., were uncovered and excavated.

The building is designed entirely of reinforced concrete, the first floor having a capacity of 700 pounds per square foot and the second floor a capacity of 400 pounds per square foot, live load. It will be

furnished with two plunger elevators, each having a carrying capacity of 6,000 pounds at a speed of 75 feet per minute.

The pouring of concrete for the foundations began on May 25, 1914, and on June 30, 15 per cent of the piers were completed to a point 4 feet below the first floor, and the excavation for the foundations was 35 per cent complete.

COMMISSARY, BALBOA.

This building is located at the west side of the junction of the new Prado of the Balboa town site and the old Balboa road and faces on the new Prado with a front width of 74 feet, extending along Balboa road 192 feet, with a height of 32 feet above the first-floor level and will be served by a track the entire length of the loading platform, the surface of which is 4 feet above the track level and at first-floor level having an area of 3,400 square feet.

Test pits excavated at the site show rock to be at an average elevation of minus 5, the ledge sloping from plus 4 to minus 15 along the diagonal of the building from south to north. The foundations of the main building are designed to rest on the rock and carry a uniform load of 10 tons per square foot. The platform foundation will rest on the decomposed rock which overlies the bed and carry a uniform load of 5 tons per square foot.

The building is designed with reinforced concrete columns and floor construction and curtain walls and partitions of hollow concrete blocks. Cement-finish floors in work and storage rooms with quarry tile in the salesrooms and wood floors behind the counters; the show windows to be finished with mahogany trim, the balance of the trim being cypress. Hardware is of solid brass throughout.

It will be furnished with a plunger freight elevator of 4,000 pounds capacity at a speed of 75 feet per minute and a refrigerator space of 6,800 cubic feet.

The excavation for foundations began on June 22; the work to June 30 consisted of removing the top soil and placing of sheath piling in the foundation pits.

SHOPS OFFICE, BUILDING NO. 23.

The foundations, structural steel, and underground plumbing work for this building were installed under the supervision of the division of terminal construction. The foundations were completed approximately January 1 and the steel erection about May 29.

In plan this building is U shaped, the main building being 120 feet by 54 feet, with two wings extending from the rear, 48 feet by 36 feet, all 62 feet high above the first-floor grade, of the same general construction as the administration building, except that the trim is entirely of California redwood and the floors have cement finish.

The roof is covered with reinforced concrete tile approximately 2 feet 3 inches by 4 feet 6 inches by 2 inches thick, resting directly on the steel purlins. It will be furnished with three fireproof vaults.

The work of this division began on this building on May 15. From that date to June 30 forms were placed and concrete poured in 20 per cent of the soffit of the roof overhang, and 85 per cent of the concrete floor arches through the building were completed and the ornamental concrete castings were 50 per cent completed. The exterior walls

were built in 70 per cent of the first story, 25 per cent of the window frames were installed, and 90 per cent of the rough plumbing was completed.

FIRE STATION.

This building is of the same construction as described for the Balboa commissary building. The trim will be entirely cypress and the second floor, or living apartments, will be covered with yellow-pine flooring. The foundation is a reinforced concrete slab covering the entire area of the building, and 14 inches thick, resting on 1 foot of crushed stone placed on the hydraulic fill of the lowland between Ancon and Sosa Hills.

The upper surface of the concrete foundation will be finished with cement finish and used as the first floor.

The building is located at the northwest end of the Prado and is 56 feet front by 38 feet deep by 34 feet high.

Work was commenced on June 19 and to June 30 the necessary excavation and rock fill had been completed, including a small retaining wall around the rock fill, 1 foot thick by an average of 3 feet in depth.

SCHOOLHOUSE.

Designs were made and the working drawings practically completed for a permanent schoolhouse of construction similar to the administration building. It was later decided that a schoolhouse of wood construction, composed of four type 5 houses to be obtained from Empire, would adequately fill the present requirements. A second plan was, therefore, prepared to cover this construction, this building to be placed on concrete foundation with piers extending 1 foot 6 inches above the ground level.

The work of placing these foundations began on June 19 and on June 30, 20 per cent of the foundation work was completed. Total number of foundation piers required is 176.

The first floor of the building will be set at approximately 8 feet above the ground, thus giving a 6 feet 6 inch headroom under the building which will provide a sheltered playground during the rainy season.

RADIO STATIONS.

Under work request from the Navy Department, through the division of terminal construction, the necessary buildings for radio stations and foundations for radio towers are under construction at Colon, Darien, and Balboa.

DARIEN RADIO STATION.

The work at the Darien radio station consists of 9 concrete anchor-age foundations, 3 for each of three 600-foot steel towers, each foundation being 16 by 20 by 15 feet, and containing the anchorage for the tower leg which rests upon it. The base of each tower covers an equilateral triangle with sides 150 feet in length, and the three towers are arranged in a triangle, the sides of which are as follows: 970 by 896 by 752 feet.

In addition to this a power house of reinforced concrete construction 30 by 62 by 20 feet; an operating building of the same construction 26 by 50 by 16 feet, and a storehouse of the same construction 16 by 24 by 12 feet have been constructed. Operators' barracks and chief electrician's quarters, the first being a two-story and the latter a one-story frame constructed building, 32 by 64 by 30 feet, and 30 by 44 by 20 feet, respectively, have been constructed. The frame buildings are complete; the foundations are complete; the first two concrete buildings are complete except floors, which can not be completed until the foundation layout for the machinery is received. The walls of the storehouse are 50 per cent complete. The work above described was commenced on October 25, 1913.

COLON RADIO STATION.

This station is located on the grounds of the old radio station at Colon. Work commenced at this station on May 2 and consists of a power house 50 by 30 by 19 feet, an operating building 20 by 30 by 16 feet high, each of concrete construction; an operators' barracks and chief electrician's quarters, the latter two being of wood construction except for the foundations, and are 44 feet front by 51 feet deep by 30 feet high, and 83 feet front by 35 feet deep by 20 feet high, respectively, also six anchorage foundations for two 400-foot radio towers.

On June 30 the six anchorage foundations were completed, the walls of the power house and operating building were complete, and the operating building was under roof. The chief-electricians' quarters had been erected and the exterior walls and roof sheathed complete, and the foundations and reinforced concrete girders for the first floor of the operators' barracks were completed and 60 per cent of the framing for this building installed.

BALBOA RADIO STATION.

This station is located at the east side of Balboa dump between Balboa road and Fort Amador, and consists of the same number and style of buildings as mentioned for Colon radio station.

The anchorage foundations at this station were installed by the erection division of the department of operation and maintenance. The work of this division was commenced on May 11.

On June 30 the power house and operating building walls and roof were complete and all trim set. All rough plumbing was complete. The foundations for the operators' barracks and chief electricians' quarters were also complete to the first floor level, and the framing for the walls and roofs of these buildings was 50 per cent complete.

LOCK-CONTROL HOUSES.

In addition to the work previously mentioned, tile roofs and floors of 2-inch red and buff hexagonal tile, also the finished plumbing, were installed in the three lock-control houses, Gatun, Pedro Miguel, and Miraflores, under work request from the erection division, department of operation and maintenance. This work is all completed.

ANCON COMMISSARY.

This building is located to the northeast of the entrance to the Ancon Hospital grounds. It is a one-story structure, 70 feet front, 110 feet deep, and 26 feet high, of the same construction as stated for the Balboa commissary. It is furnished with a loading platform of 1,400 square feet area and refrigerating space of 2,300 cubic feet.

The construction work was performed by one of the traveling gangs, usually engaged in reerection and maintenance work, the gang being composed of 1 gold and an average of 40 silver men.

Excavation started on October 21, 1913, and on June 30 the entire building was 98 per cent complete.

FORCE.

The average daily force employed by this division each month on the construction of the permanent buildings mentioned is as follows, considering only the days when work was actually in progress:

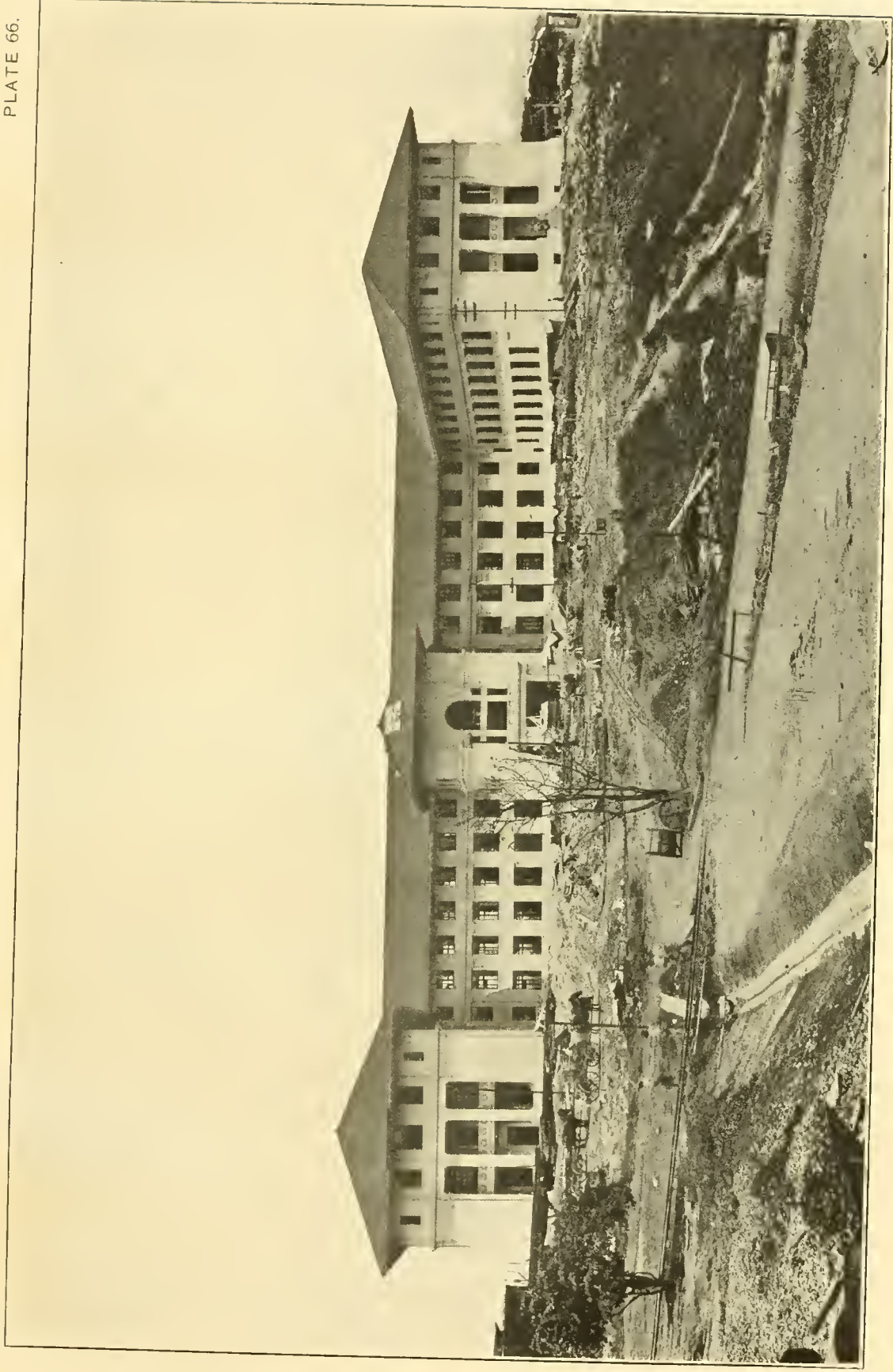
Month,	Gold employees.	Silver employees.
1913.		
September.....	8	214
October.....	17	368
November.....	54	791
December.....	78	1,173
1914		
January.....	91	1,719
February.....	131	1,501
March.....	184	2,056
April.....	257	2,279
May.....	370	2,544
June.....	394	2,912

On June 30 the actual force employed on said buildings was 420 gold men and 3,224 silver men.

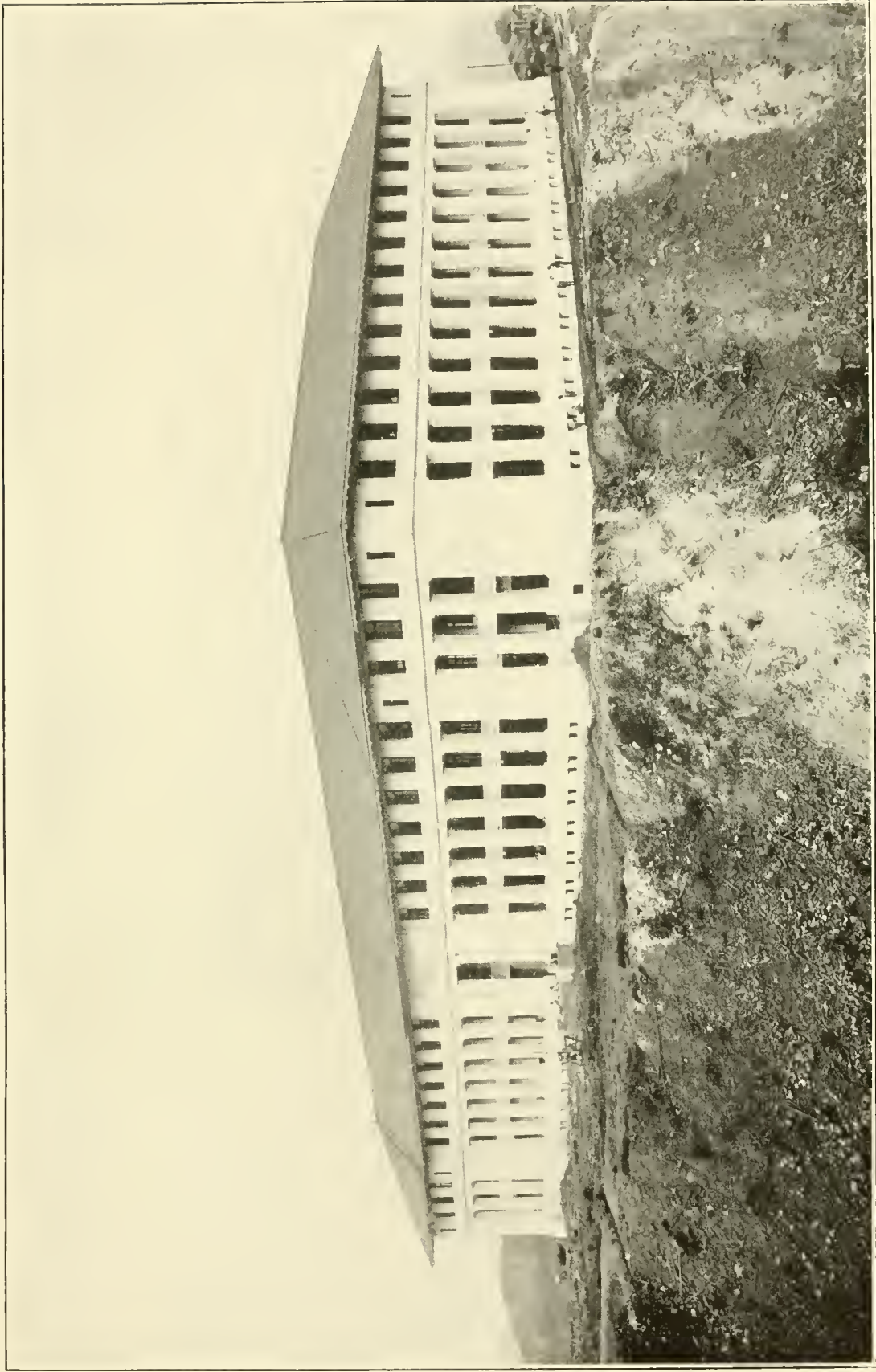
The constant increase in the proportion of gold employees as compared with the silver men employed, shown in this statement, is due to the necessary introduction of skilled mechanics of the building trades, such as brick masons, roofers, tile setters, plasterers, plumbers, and carpenters, to perform the work for which the silver employees were not adequately trained.

Respectfully submitted.

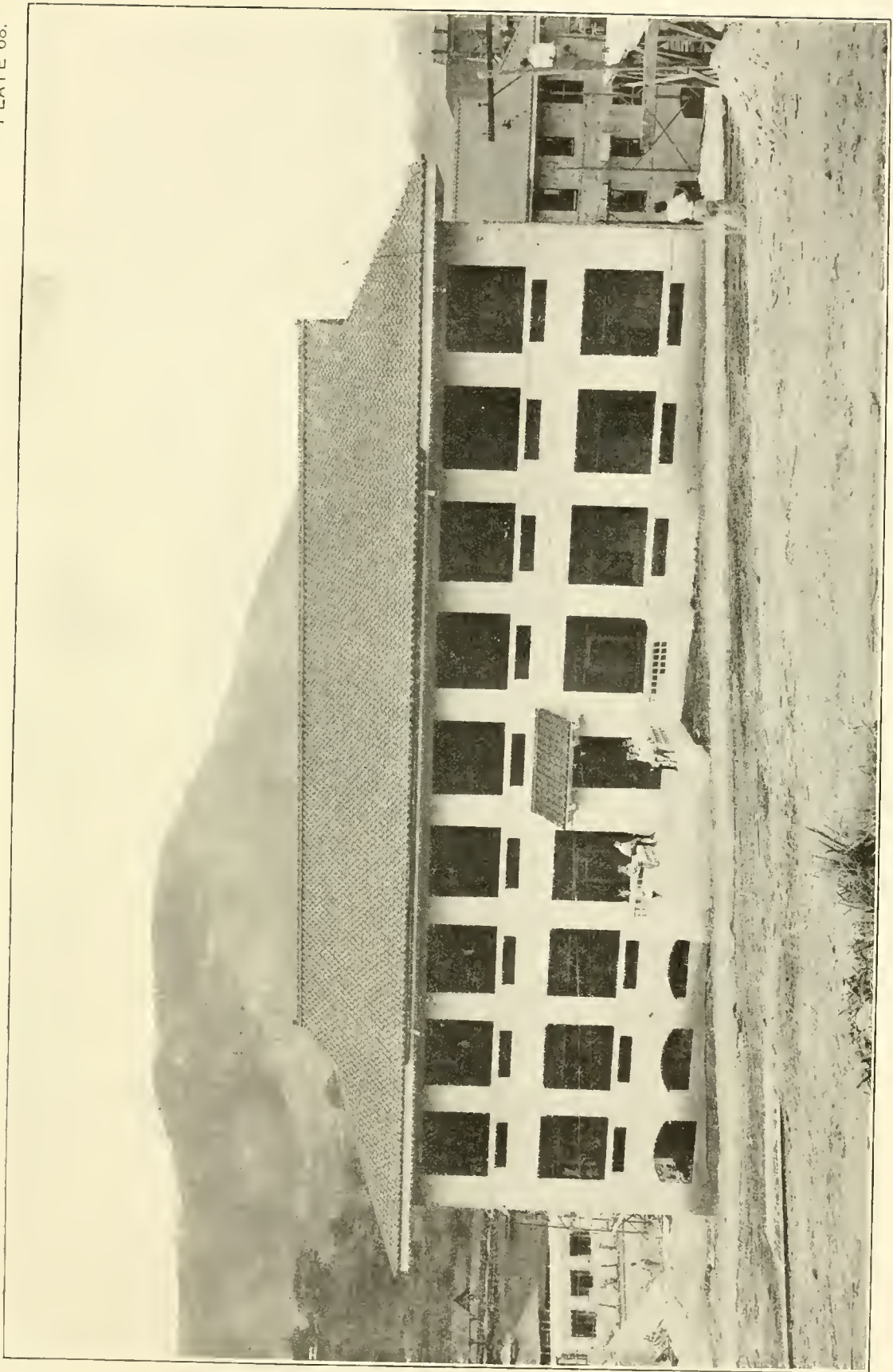
FRANK HOLMES,
Resident Engineer.



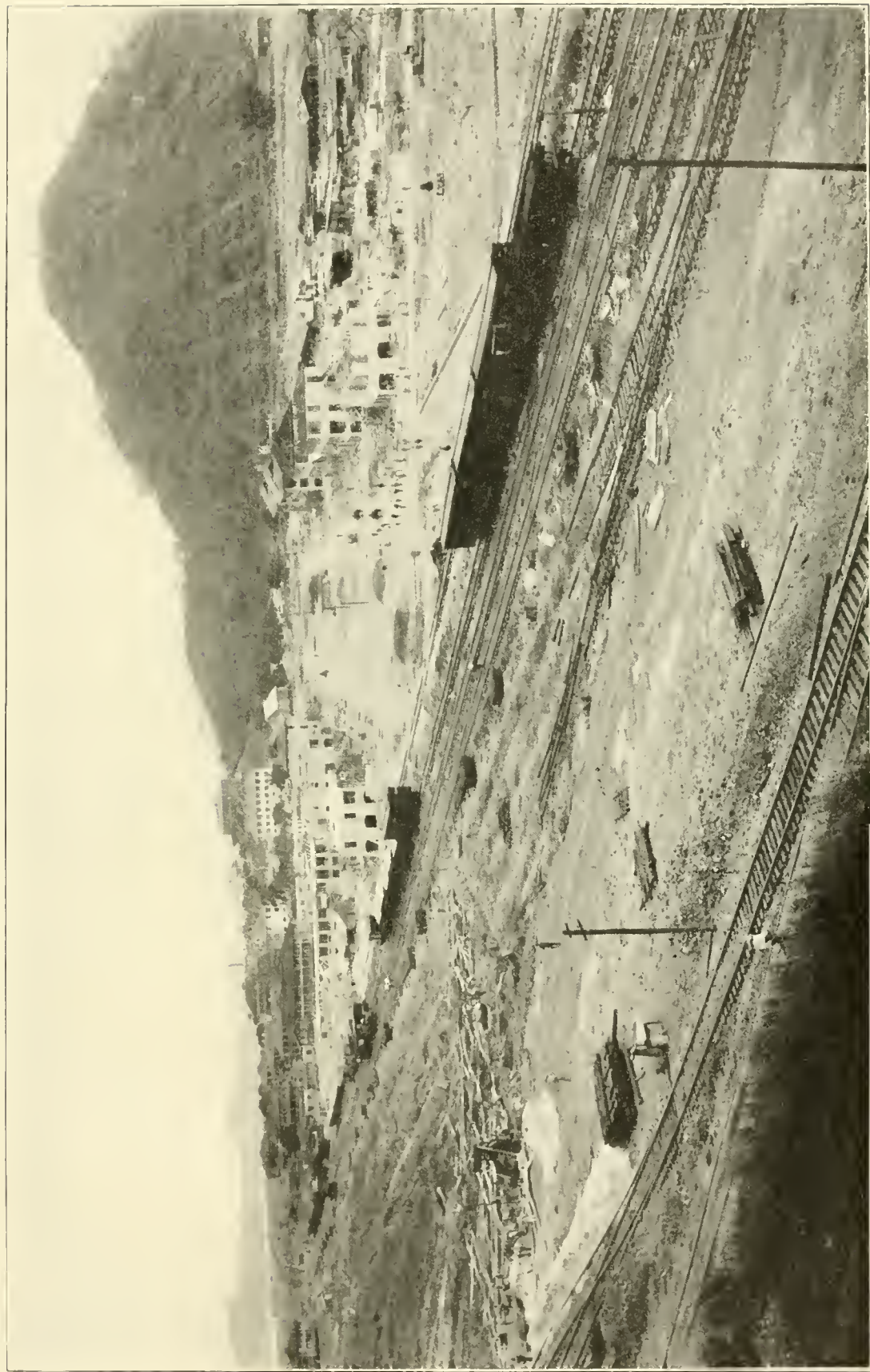
NEW ADMINISTRATION BUILDING, NORTH FRONT, BALBOA HEIGHTS.



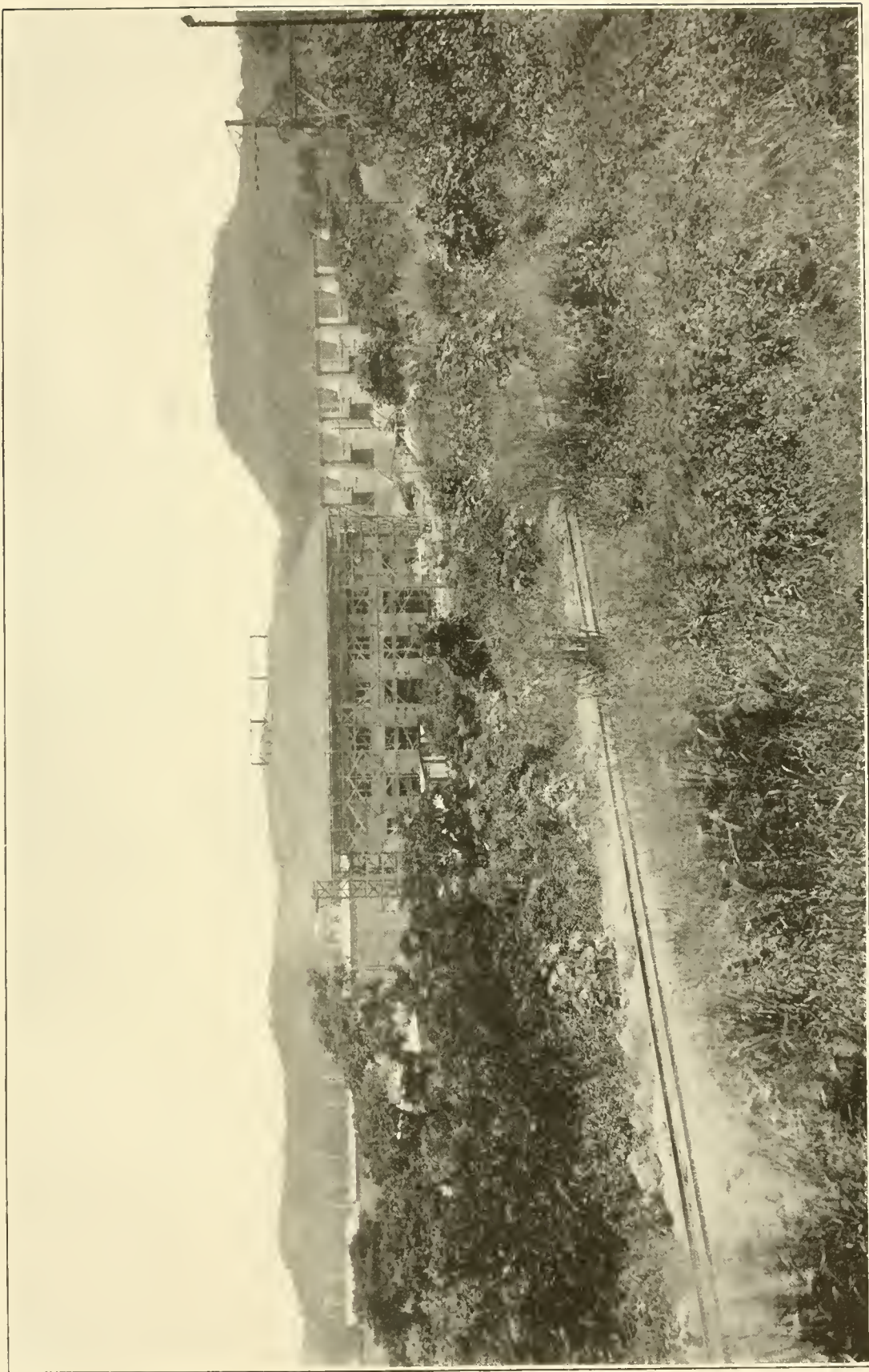
NEW ADMINISTRATION BUILDING, SOUTH FRONT, BALBOA HEIGHTS.



COMPLETED FOUR-FAMILY HOUSE IN THE NEW VILLAGE OF BALBOA.



THE NEW VILLAGE OF BALBOA FROM THE ADMINISTRATION BUILDING.



THE TRANSMISSION LINE SUBSTATION AT MIRAFLORES.

APPENDIX G.

REPORT OF THE AUDITOR IN CHARGE OF THE ACCOUNTING DEPARTMENT.

BALBOA HEIGHTS, *September 1, 1914.*

SIR: I have the honor to submit the following report of the transactions of the accounting department for the fiscal year ending June 30, 1914, including the transactions of the offices and departments which were consolidated into the accounting department on April 1, 1914.

ORGANIZATION.

The accounting department was established through a consolidation of the department of examination of accounts, the department of disbursements, and the office of the treasurer of the Canal Zone. It took over a part of the accounting work performed by the collector of revenues, by the executive office of the department of civil administration, and by the department of sanitation. The duties of receiving, disbursing, and accounting for funds in the United States, which were performed by the disbursing officer and the assistant examiner of accounts in Washington, were also transferred to the jurisdiction of the accounting department.

The department now consists of three main divisions—a division of accounts and audits under the immediate direction and control of the auditor, a division of disbursements under the paymaster, Mr. John H. McLean, and a division of receipts under the collector, Mr. T. L. Clear, the latter two divisions being under the supervision of the head of the department. The office of the department in the United States is in charge of the assistant auditor, Mr. B. F. Harrah, with Mr. Virgil C. Miller as disbursing clerk. To the latter is assigned the duty of paying all bills in the United States and the making of the small collections there. The order establishing the permanent organization for The Panama Canal provided that cost keeping should be a part of the work of the accounting department, but it was deemed inadvisable to make any changes in this work until the offices were consolidated in the administration building at Balboa Heights.

Prior to the reorganization of April 1, 1914, certain other changes were made which increased the duties assigned to the department. In January, 1914, the preparation and rendition of property returns by storehouses was discontinued and a division established in the office of the examiner of accounts to prepare statements of receipts, issues and balances of stores under a somewhat detailed classification, and to check the stock in storehouses and stock records on the general plan followed by railroads and other large commercial enterprises. On April 1, 1914, the rendition of all property returns was discontinued and arrangements made to check the original record of property in department and division offices. The force employed in accounting work for the commissaries of the Panama Railroad Co. and

for the hotels operated by the subsistence department was transferred to this department in February, in line with the general policy of consolidation of all accounting work.

The most pronounced and satisfactory change in procedure in connection with the work of the department was begun on May 1, 1913, and made completely effective August 1, 1913, at the time of the appointment of Mr. John H. McLean as disbursing officer of the Isthmian Canal Commission. Effect was then given to the provision contained in the legislative, executive, and judicial appropriation act approved August 23, 1912, that "disbursing officers shall make only such examination of vouchers as may be necessary to ascertain whether they represent legal claims against the United States." A reduction of \$20,000 per annum in expense was made without decreasing in any way the safeguards connected with the disbursement of public funds, as is clearly shown by the result of a careful audit of the accounts made after payment in the office of the Auditor for the War Department. Returns from the Auditor for the War Department have been received for the eleven months beginning May 1, 1913, and ending March 31, 1914. Over 40,000 pay-roll items were passed each month after a careful examination and check in the office of the examiner of accounts and auditor, a total during the eleven months of more than 450,000. The amount involved did not average less than \$1,400,000 per month, making a total of over \$15,400,000. During that period a total of 32 pay-roll items, in amount \$230.64, were suspended by the Auditor for the War Department. Of these items, 20 only constituted actual overpayments, amounting to \$121.65. Collections on this account were made from the employees overpaid in all except eight cases, on account of which employees of the auditing office have been required to pay \$25.50.

PERMANENT ACCOUNTING SYSTEM.

During the latter part of October and during November and the first part of December, 1913, a committee from the Treasury Department, consisting of Mr. W. W. Warwick, Assistant Comptroller of the Treasury; Mr. H. A. Harding, of the Comptroller's office, and Mr. F. H. Fields, of the office of the Auditor for the War Department, were on the Isthmus studying the accounting system of The Panama Canal and considering the relations which the accounting on the Isthmus should bear to the accounting work of the United States as carried on by accounting officers of the Treasury. No final conclusions were reached by this committee and made effective on the Isthmus. Just prior to the change in organization on April 1, 1914, the Treasury Department again sent the committee to the Isthmus with Mr. J. L. Baity, the Auditor for the War Department, himself, in place of Mr. Fields. The committee devoted about six weeks to their work on the Isthmus and approved certain forms for use in connection with the rendition of public accounts and made certain suggestions in regard to other matters relating thereto. The forms approved by direction of the Comptroller of the Treasury have been put into use. The suggestions which were made have been held pending a consideration of the necessities which will arise in connection with the actual operation of the canal.

During the period from October, 1913, to April, 1914, the services of Mr. Francis Oakey were engaged in formulating the principles upon which the accounting system for The Panama Canal should be based. He left the service before the final details could be worked out, but it is believed that the fundamental principles enunciated by him will be found applicable to the conditions which will exist in connection with the operation of the canal. Methods of accounting which were satisfactory during the construction period could not be expected to be satisfactory for one of the largest and most complicated commercial enterprises. The essentials of a satisfactory system of commercial accounting must be grafted upon and be not inconsistent with the accounting system of the United States, designed almost solely for keeping accounts and safeguarding the disbursement of public funds. Besides the primary purpose of the canal, that of passing vessels from one ocean to the other, for which toll charges will be made, The Panama Canal organization under the law undoubtedly will operate with Government funds large hotels and small dining rooms; hospitals for all classes of patients with various rates of charges for services; it must furnish supplies of all kinds, subsistence as well as general supplies, including coal, water, and fuel oil; it will repair vessels and every other kind of equipment and appliance, including the repair of the largest merchant or war vessel; it will furnish the services of tugs, cranes, barges, docking facilities, and wharf space; it must operate laundries, ice plants, power plants, and numerous other enterprises which are usually carried on separately by commercial establishments. It also has the railroad to operate as an adjunct of the canal.

These business enterprises require more elasticity in accounting than can be obtained by the application of some of the exceedingly technical and to some extent, at least, nonessential practices that have been followed in some of the auditing offices of the Government. While as far as possible it was considered advisable to follow the old classification of accounts from April 1 to June 30, 1914, a new classification of accounts has been formulated and put into effect to a certain extent. Beginning with the fiscal year 1915 the accounts will be completely classified thereunder. One of the most essential elements is the setting up of distinct revenue accounts for work done for outsiders to offset the corresponding expenditure accounts, these accounts being necessary in order to determine annually under the law the net profits on business operations so that the amount thereof may be covered into the Treasury. To the account for maintenance and operation there was charged during the year the sum of \$161,608.52.

The consolidation of all accounting work for the canal, the railroad, and the Zone government, as authorized by section 4 of the sundry civil act of August 1, 1914, especially after the offices have moved to Balboa Heights, can result only in reduced expenses therefor. It will eliminate the necessity for the several registers now used in handling accounts in different offices and will permit the making of charges to the expenditure accounts by methods of distribution rather than through the rendition of bills by one interest of the canal against other interests. One careful check of all accounts can be substituted for several, which are probably made of many items now. In the same manner the making of payments to all employees by one force will reduce the cost of making such payments, as the same force can make

the additional payments required by the railroad without any material increase in expense. The consolidation of all collecting of funds under one force will eliminate the necessity of keeping several collecting officers in one town, as has been the practice in the past. One collecting office at Cristobal can handle all collections for the railroad, canal, and Canal Zone government just as satisfactorily as three.

PANAMA AND COLON WATERWORKS ACCOUNTS.

Under the agreement with the Republic of Panama which requires the reimbursement of the United States for the expenditures incurred in connection with the construction, maintenance, and operation of waterworks, sewers, and pavements within the cities of Panama and Colon, the total expenditures to June 30, 1914, in the city of Panama were \$1,761,328.49 and in the city of Colon \$1,659,640.20, a total of \$3,420,968.69. This amount includes accrued interest to date at the rate of 2 per cent per annum on the capital cost balances and on the proportionate cost of the waterworks in the Canal Zone used for supplying water to the two cities, such proportion being based on the quantity of water consumed. For the work in Panama this interest has amounted to \$186,588.26 and for the work in Colon \$139,665.63. There has been reimbursed the United States \$1,213,918.37, leaving a balance of \$2,207,050.32 still due. Included in the amount reimbursed the sum of \$37,769.06 represents the value of water used by The Panama Canal in the two cities.

MISCELLANEOUS WORK.

On April 1, 1914, the duty of purchasing commissary coupon books was transferred to this department, as was the duty of issuing books to the issuing clerks of The Panama Canal. During the year 41,223 hotel books, valued at \$580,319.40, and 980,283 meal tickets, valued at \$353,253.20, were issued. In addition there was collected on the pay rolls of The Panama Canal the sum of \$2,888,437.50 for 519,956 commissary books issued to canal employees.

The periodical examination of all fiscal officers' records of financial transactions and the audit of their accounts has been continued. A complete check of the records, cash, and cash values in the hands of about 225 officers and employees having the collection, custody, and disbursement of money, including the disbursing officer, the treasurer of the Canal Zone, the paymaster and the collector, cashiers of water-collecting offices, hotels, postmasters, clerks of court, et al., have been made.

The schedule bond executed by the Illinois Surety Co., under which nearly 300 employees of the canal were bonded for the faithful performance of their duties, involving responsibility for money or money values, was discontinued June 30, 1914, and a new bond executed by the Maryland Casualty Co. at a rate of 65 cents for postal clerks, \$1.25 for postmasters, and \$1.70 for other employees, as against the previous rate of \$3 per thousand dollars.

There has been passed to the disbursing officer and paymaster on the Isthmus for payment audited vouchers amounting to \$8,962,-460.68 and pay rolls amounting to \$19,764,814.92. The total disbursements on the Isthmus on account of salaries and wages of

employees and on account of other items amounted to \$27,749,135.69. Disbursements in the United States amounted to \$14,614,403.71, a total during the year of \$42,363,539.40. The payments on the Isthmus on account of salaries and wages of employees amounted to \$19,344,379.82. On account of the steady withdrawal of gold coin from circulation, three shipments of money from the States to the Isthmus were required, a total amount of \$1,700,000. It is evident that gold coin is carried away by American employees, European and West Indian laborers leaving the country on account of large reduction of force due to completing different parts of the work. The balance of the necessary supply of coin was obtained by the disbursing officer and paymaster as heretofore from local banks in Panama and Colon and from the Canal Zone post offices in exchange for drafts on the Treasurer of the United States, and from collections due The Panama Canal. The paymaster reports that the supply of local silver has been running about 800 bags of 1,000 pesos each per month. Local silver is counted, wrapped in rolls of suitable denominations, and paid to laborers on the pay car and at the different pay offices. (See Table No. 9.) The total collections for The Panama Canal during the year have amounted to \$8,106,469.42, of which \$4,718,024.30 was repaid to appropriations, \$397,365.02 deposited as miscellaneous receipts, and \$2,963,148.96 collected on account of Panama Railroad commissary. The balance, \$27,931.14, was collected for the account of the railroad, bonding company, and other contractors.

The inspection of timebooks and the work of timekeepers in the field was continued for the purpose of preventing the padding of time books and insuring the performance of timekeeping in the field in accordance with the regulations. A great number of minor errors were discovered, and several cases of fraudulent practices located, indicating the necessity for continuing the work of this division.

For the six months this office has maintained records of purchases and sales of quartermaster's stores there has been received material and supplies of a total value of \$7,887,431.66, of which \$4,840,245.92 was for stock and \$3,047,185.74 was for material, supplies, and equipment delivered direct to construction divisions. During this period the issues from storehouses have amounted to \$5,423,585.41, while the amount received from direct sales to outside interests totaled \$142,377.56. The total amount received during the year from the sale of material, supplies, and equipment, including the amount derived from such items as were used in connection with work done for purposes other than canal and from issues to the Panama Railroad and Canal Zone government was \$1,741,196.18. There was received on account of stock, material, and supplies \$1,468,426.64, about \$1,000,000 of which was from the Panama Railroad Co. and Canal Zone government. Two hundred and eight thousand eight hundred and forty-five dollars and seventy-five cents derived from the sale of construction material and equipment, and \$13,968.79 from the sale of French material and equipment was deposited in the Treasury as miscellaneous receipts, United States funds, and \$49,955 was credited to appropriations as a reimbursement for expenses incurred in making such sales. The inventory balance of stock in storehouses on January 1, 1914, amounted to \$3,731,765.97; on July 1, 1914, \$4,333,611.37. (See Table No. 39.)

The commissary accounts show that supplies to the value of \$5,489,463.37 were purchased during the year. Groceries purchased cost \$1,486,425.32; cold storage, \$2,165,898.60. Supplies costing \$5,662,744.56 were sold for the sum of \$6,823,162.29. Sales to The Panama Canal amounted to \$1,626,635.76; to other branches of the United States Government, \$232,857.88, and to steamship companies \$10,779.98; for coupons issued to employees and others entitled to purchase from the commissaries, \$4,623,357.93. On the total value of supplies sold the average surcharge added to the cost delivered on the Isthmus was 18 per cent. Supplies to the value of \$4,287,615.30 were purchased in the United States, \$722,840.14 from foreign countries, and \$452,282.12 on the Isthmus. (See Tables. Nos. 40 and 41.)

CANAL ZONE ACCOUNTS.

The separate business of the Canal Zone has reduced materially during the year, as is shown by the tables of financial transactions attached to this report. The amount of revenues derived from rentals, taxation, etc., has decreased from \$212,266.83 in 1913 to \$168,076.64 in 1914. The audited expenditures during the year amounted to \$261,064.17. In the operation of the post offices there was a decrease in the number of orders issued from 238,316 in 1913, to 198,009 in 1914, with a reduction in amount from \$4,883,624.13 to \$4,029,364.97. Fees amounting to \$19,408.44 were collected, as against \$23,366.31 for the prior fiscal year. The total amount of money orders issued to June 30, 1914, was \$36,583,992.49. The greater part of the orders drawn are on the United States, and on account of such orders the sum of \$3,400,000 was remitted during the year to the Postmaster General of the United States. On June 30 there was a balance of \$471,422.73 due the United States on account of money orders actually paid by that Government and returned to the Auditor for the Post Office Department for audit and transmittal to the Isthmus.

Postage stamp revenues received during the fiscal year 1914 amounted to \$91,256.30, a reduction from \$100,917.99 received during the fiscal year 1913, although an increase over the \$87,641.45 received during the fiscal year 1912. I again reiterate the recommendation made in previous reports that the postal system of the Canal Zone be relieved of the payment of 40 per cent of all stamp revenues to the Republic of Panama. To June 30, 1914, payments on this account have amounted to \$277,333.42.

Postal savings certificates amounting to \$1,708,530 were issued during the year, while the withdrawals amounted to \$1,855,739. The amount on deposit in the postal savings banks June 30, 1914, was \$489,818. The major portion of the funds of the Canal Zone have continued on deposit with the two depositories in Washington, although an amount not exceeding \$100,000 is deposited in one of the banks on the Isthmus. The amount on deposit in all depositories June 30, 1914, was \$1,594,285.53, against \$2,168,339.62 on June 30, 1913. These funds are secured by the deposit of high grade bonds under the control of a representative of the Government. The interest received on deposits during the year amounted to \$61,354.12, as against \$32,647.77 received during 1913. This amount makes more than one-third of the total revenues of the Canal Zone exclusive of postal revenues. The total amount of interest received to the end of the fiscal year was \$179,418.19.

Canal clubhouses received a total revenue of \$132,624.05 and expended \$133,086.95. The balance June 30, 1914, in clubhouse funds amounted to \$26,513.96. The obligations outstanding against this item amounted to \$10,534.53, leaving available a balance of \$15,979.43.

CLAIMS FOR INJURIES AND DEATHS.

The provisions of the injury compensation act of May 30, 1908, as amended by section 5 of the act of March 4, 1911, was superseded April 1, 1914, by the Executive order of the President of March 20, 1914, which was promulgated in accordance with the authority contained in section 5 of the Panama Canal act. In addition to the methods of settlement under the law, the settlement of claims has been somewhat complicated by the provisions of the Executive order of February 26, 1913, which were made effective by President Taft on March 1, 1913, and suspended by President Wilson on March 24, 1913, on account of the failure of an appropriation to meet any claims which might be allowed. The Comptroller of the Treasury first held that during the interim from March 1 to March 23 the Executive order was inoperative and all claims were allowed during that period in accordance with the provisions of the general compensation law authorizing payment for periods of disability not exceeding one year at the rate of compensation received by the injured employee at time of injury. Later it was held that the Executive order was in effect covering the period, and on account of three claims filed thereunder a total of \$7,808.71 was allowed. These decisions resulted in paying the higher compensation under the two provisions. In drafting the Executive order it was intended that the reduced allowances during short periods of disability due to minor injuries would permit larger allowances in cases of permanent disability and death without any additional draft upon the funds of The Panama Canal, which was already paying injury compensation at the rate of nearly \$250,000 per annum, and has paid since August 1, 1908, the sum of \$1,145,085.71.

Under the general compensation law there have been allowed since July 1, 1913, a total of 975 claims, while 148 claims were disallowed on account of injuries received. Of the disallowed claims the following are the reasons given: Disability lasting less than 15 days, 90; injury not received in course of employment, 30; claimant not employee of The Panama Canal, 1; accidents described not the cause of incapacity, 53; disability caused by illness, 11; insufficient evidence to establish connection between alleged injury and incapacity, 39; negligence and misconduct, 10. Fifty-two death claims were allowed, while 8 were disallowed for reasons as follows: Claimants not considered dependent parents within the meaning of the act, 5; employees not in course of employment, 2; deceased not employed by Commission, 1.

Under the act of February 24, 1909, authorizing the Isthmian Canal Commission to grant meritorious sick leave to injured employees for not exceeding 30 days in any one year, which has been restricted in most cases to the periods of disability lasting 15 days or less, 3,610 cases were allowed. The average duration of disability for which injury compensation claims have been filed is 50 days. The average

estimated duration of cases in which meritorious sick leave has been granted is eight days.

The first effect of the compensation order of April 1, 1914, which provides for the payment of partial compensation of 75 per cent of the monthly pay of an employee for three months and 50 per cent thereafter, instead of the total compensation received by an employee during the period of disability not exceeding one year, was a big reduction in the amount paid to employees on account of injuries, the amount allowed for the first three months of the operation of the order being \$4,283.83. This amount does not represent the total amount that will be allowed on account of injuries received during the period, as no allowances were made on account of long continuing periods of disability nor on account of death claims. When these cases are allowed it will increase materially the amount allowed, as the maximum allowance under the injury compensation law itself was a year's pay, whereas under the order an employee permanently disabled, or his dependents in case of his death, may receive the maximum of \$5,000, if his compensation was \$125 or more per month. However, unless many serious accidents occur in the future and in greater number than in the past, the amount paid under the new order, in proportion to the number employed, will not be as great as the amount paid under the original compensation act of May 30, 1908. Many questions are arising under the order for which there are absolutely no precedents, but the order appears to be susceptible of practical administration, in view of the fact that a limit is placed upon the total amount which may be paid in any one case and a schedule of compensation is provided which enables the administrative officer to make a much fairer settlement than was possible under the general compensation law. It is not subject to the same practical objections as the Executive order of February 26, 1913, the settlement of the three claims under which were involved in serious disagreement, as that order afforded no guide whatever to the amount of the payments required.

CANAL APPROPRIATIONS.

Congress has appropriated a total of \$374,048,194.59 for the canal, including the appropriation contained in the sundry civil act approved August 1, 1914. Of this amount \$12,050,825 was for fortifications, \$1,124,525 of which is contained in the current act; \$22,508.01 was appropriated for the relief of private persons; \$361,974,861.58, including \$20,718,000, appropriated August 1, 1914, was for the construction of the canal and its adjuncts. Except for the portion used in maintaining and operating the canal (to which \$161,608.52 was charged during the year), and the \$2,000,000 appropriated for colliers, that amount is a charge against the total authorized bond issue of \$375,200,900, as fixed by section 29 of the tariff act of August 5, 1909. If about \$3,250,000 of the amount now appropriated is used in operating and maintaining the canal to June 30, 1915, there may still be appropriated for canal construction about \$18,500,000. Of this amount probably \$5,000,000 will be required to meet the obligations incurred during the fiscal year 1915.

The actual cash balance on hand June 30, 1914, for the construction of the canal was \$6,588,550.34, a large reduction from the \$20,673,904.79 available June 30, 1913. The cash available under appropriation items 2, 3, 4, 7, and 10 was insufficient to meet

the charges payable from such appropriations immediately after July 1, 1914. Fourteen thousand eight hundred and sixty-seven dollars and sixty-three cents of item 5 was used to meet expenses incurred under item 2. The rolls covering accrued leave due and payable after the permanent organization was put into effect April 1, amounting to \$906,436.91, caused a large part of the shortage in items 3, 4, 7, and 10. The deficiencies in the four appropriation items, not considering the bills the major portion of which were not payable so that the money was available to meet the immediate needs, were about as follows:

Item 3, pay of officers and employees on Isthmus.....	\$400,000
Item 4, Isthmus pay rolls.....	750,000
Item 7, pay of officers and employees, Canal Zone.....	30,000
Item 10, pay of sanitary officers and employees.....	65,000

To meet the deficiency in item 3, \$272,500 of the balance in the appropriation "Relocation of Panama Railroad" and \$100,000 in the appropriation "Canal connecting the Atlantic and Pacific Oceans" was used. To meet the deficiency in item 4, \$112,500 of the appropriation "Relocation of Panama Railroad" and \$500,000 of item 5, "Miscellaneous material purchases, etc., on Isthmus, Isthmian Canal," were used. Any balance required under these two appropriations and the deficiency in item 7 was provided for out of the current appropriation for the year 1915. To make good the deficiency in item 10, \$35,000 of appropriation item 11, "Sanitary pay rolls on Isthmus, Isthmian Canal," and \$10,000 of the appropriation "Material and expenses, sanitary department, Isthmian Canal," were used. The cash balance in item 5 was reduced from \$12,879,240.41 July 1, 1913, to \$3,651,466.06 June 30, 1914. Chargeable against this appropriation were the bills for material and supplies delivered prior to July 1, amounting to about \$2,725,000. The total obligations outstanding and unpaid on June 30, 1914, including amounts unpaid on contracts and requisitions for material for delivery during the fiscal year 1915 were \$9,704,133.04. These figures indicate that the amount appropriated by the sundry civil act, \$9,000,000, will not be sufficient to meet the obligations which may be incurred between July 1, 1914, and June 30, 1915.

Six million two hundred and fifty-four thousand two hundred and three dollars and thirty-seven cents were collected and returned to the Treasury as "miscellaneous receipts" to June 30, 1914. This item represents the total amount appropriated by Congress which after being used for miscellaneous purposes in connection with the original work has been covered back into the Treasury and lost to canal appropriations. It includes payments made by the Panama Railroad Co. on account of loans, \$1,687,714.92; interest on loans, \$473,194.27; annual subsidy, \$631,875; and dividends, \$344,945; a total of \$3,137,729.19. For the reasons stated in my prior reports, that the payment of this amount into the Treasury rendered it impossible for the railroad company to renew its roadbed and equipment, and necessitated the expenditure of moneys appropriated by Congress directly for rebuilding and reequipping the railroad, and required the canal to pay higher prices for material sold and services rendered by the railroad company, the deposit of this money in the Treasury may be considered as having reduced the total appropriations available for canal purposes.

Table 1 shows the total amount made available for canal purposes as \$335,002,658.21. To this amount should be added certain amounts collected between July 1, 1908, and June 30, 1913, the original expenditures for which were included in the estimates for the canal made in 1908. The two items in question are, first, the \$506,013.02 received in reimbursement of the expenditures incurred in installing water-works, sewers, and pavements in the cities of Panama and Colon, after adding the interest on the capital cost and deducting the cost of operation and maintenance, and second, the net amount received from the sale of French scrap and from the sale of unserviceable equipment or equipment no longer required for canal construction purposes, approximately \$200,000. The total amount received from the sale of such scrap and equipment during the period stated was \$325,696.20. The total available for construction purposes to June 30, 1914, was therefore \$335,708,671.23.

Respectfully,

H. A. A. SMITH,
Auditor Panama Canal.

Col. GEO. W. GOETHALS, United States Army,
Governor of the Panama Canal, Balboa Heights, Canal Zone.

INDEX TO TABLES SUBMITTED WITH REPORT OF THE AUDITOR, PANAMA CANAL FOR THE FISCAL YEAR 1914.

- TABLE 1. Moneys available for and applied to the purchase of canal rights and cost. of canal construction to June 30, 1914.
- TABLE 2. Receipts, disbursements, and balances available June 30, 1914.
- TABLE 3. Appropriations to June 30, 1914.
- TABLE 4. Deposits in Treasury as miscellaneous receipts to June 30, 1914.
- TABLE 5. Classified expenditures.
- TABLE 6. Plant and equipment purchased and absorbed in canal construction to June 30, 1914.
- TABLE 7. Receipts and disbursements from appropriations.
- TABLE 8. United States funds disbursed on Isthmus.
- TABLE 9. Shipment of cash to Isthmus.
- TABLE 10. Classified statement of collections.
- TABLE 11. Collections on pay rolls.
- TABLE 12. Audited pay rolls.
- TABLE 13. Accounts receivable registered.
- TABLE 14. Expenditures for maintenance and operation.
- TABLE 15. Hotel coupons and meal tickets honored.
- TABLE 16. Commissary and hotel coupon books and meal tickets issued.
- TABLE 17. Canal Zone funds, revenues collected.
- TABLE 18. Canal Zone funds, expenditures.
- TABLE 19. Canal Zone funds, balances with collector June 30, 1914.
- TABLE 20. Canal Zone funds, receipts and disbursements May 1, 1904, to June 30, 1914.
- TABLE 21. Canal Zone funds, receipts by fiscal years.
- TABLE 22. Canal Zone funds, expenditures by fiscal years.
- TABLE 23. Value of money orders issued and paid, etc., 1906 to 1914.
- TABLE 24. Money orders issued and paid, by months.
- TABLE 25. Money orders issued and paid, by offices.
- TABLE 26. Postal receipts, postal savings transactions.
- TABLE 27. Clubhouse receipts and disbursements.
- TABLE 28. Clubhouse receipts.
- TABLE 29. Clubhouse disbursements.
- TABLE 30. Injury and death payments, 1908 to 1914.
- TABLE 31. Injuries sustained by employees, acts of May 30, 1908, and Feb. 24, 1909.
- TABLE 32. Injury compensation payments under Executive order of Mar. 20, 1914.
- TABLE 33. Causes of fatal and nonfatal accidents, fiscal years 1913, 1914.
- TABLE 34. Nature of injuries received, fiscal years 1913, 1914.
- TABLE 35. Causes of injury, Apr. 1 to June 30, 1914.
- TABLE 36. Character of work at time of injury, Apr. 1 to June 30, 1914.

TABLE 37. Panama Railroad Co. employees, causes of injury, Apr. 1 to June 30, 1914.

TABLE 38. Panama Railroad Co. employees, character of work at time of injury, Apr. 1 to June 30, 1914.

TABLE 39. Purchases of material and supplies and storehouse transactions, Jan. 1 to June 30, 1914.

TABLE 40. Panama Railroad commissary, purchase and sales.

TABLE 41. Panama Railroad commissary, distribution of sales.

TABLE 42. Classified expenditures from regular appropriations for civil government and from Canal Zone funds combined, for fiscal year and from beginning.

TABLE 1.—*Statement of moneys available for and applied to the purchase of canal rights and cost of canal construction to June 30, 1914.*

Appropriations by Congress (Table 3).....	\$352, 205, 669. 59
Less:	
Appropriations for fortifications.....	\$10, 926, 300. 00
Private acts.....	\$21, 411. 56
Judgments, Court of Claims.....	1, 096. 45
	<u>22, 508. 01</u>
Collections returned to the United States Treasury as miscellaneous receipts and lost to canal appropriations (Table 4).....	6, 254, 203. 37
	<u>17, 203, 011. 38</u>
Net amount available.....	335, 002, 658. 21
Classified expenditures (Table 5).....	332, 939, 626. 28
Less:	
Fortifications.....	\$6, 793, 089. 73
Private acts and judgments, Court of Claims.....	19, 008. 01
	<u>\$6, 812, 097. 74</u>
Unapplied credits to expenditures:	
Water rentals.....	1, 213, 918. 37
French scrap used or sold.....	1, 242, 893. 97
Unpaid rolls on June 30, 1914.....	\$2, 429, 829. 15
Less unpaid amounts on rolls for fortifications....	96, 159. 47
	<u>2, 333, 669. 68</u>
Subsidies from Panama Railroad Co.....	631, 875. 00
Dividends from Panama Railroad stock...	344, 945. 00
Interest on loans to Panama R. R. Co.....	473, 194. 27
Miscellaneous rentals.....	239, 099. 57
	<u>13, 291, 693. 60</u>
Net charges to classified expenditures.....	319, 647, 932. 68
Material and supplies and other unclassified items (Table 2) less	
\$71,199.88 for fortifications.....	10, 191, 367. 61
Accounts receivable.....	1, 406, 156. 75
Due on Treasury Department transfers from fortifications.....	610, 631. 33
Unexpended appropriation balances (Table 7) except \$4,772,434.84 for fortifications and private acts.....	6, 588, 550. 34
Maintenance and operation of canal.....	161, 608. 52
	<u>338, 606, 247. 23</u>
Less accounts payable.....	3, 603, 589. 02
Total accounted for.....	335, 002, 658. 21

TABLE 2.—*Statement of receipts, disbursements, and balances available June 30, 1914.*

RECEIPTS.

Appropriations by Congress (Table 3).....	\$352, 205, 669. 59
Water rentals, Panama and Colon.....	1, 213, 918. 37
Salvage from French material and equipment.....	1, 242, 893. 97
Collections account sale of Government property, etc. (Table 4)....	6, 254, 203. 37
Collections due individuals and companies.....	4, 289. 97
Total receipts.....	<u>360, 920, 975. 27</u>

TABLE 2.—*Statement of receipts, disbursements, and balances available June 30, 1914—Continued.*

DISBURSEMENTS.		
Classified expenditures (Table 5).....		\$332,939,626.28
Civil government and law.....	\$7,217,404.53	
Health department.....	17,259,797.30	
Hospitals and asylums.....	\$9,001,531.15	
Sanitation.....	7,109,744.63	
Construction and repair of buildings.....	1,148,471.52	
Construction and engineering.....	211,295,071.34	
Atlantic.....	\$58,017,714.17	
Central.....	89,230,174.20	
Pacific.....	59,206,213.64	
General.....	4,840,969.33	
General items.....	90,374,263.38	
Fortifications.....	6,793,039.73	
Maintenance and operation of canal.....		161,608.52
Paid into the United States Treasury for sales of Government prop- erty, etc.....		6,254,203.37
Services rendered and material sold to individuals and companies..		4,565,089.53
Unclassified expenditures.....		10,262,567.49
Material and supplies.....	\$5,840,943.01	
Other unclassified items, including suspense accounts for Ancon-Sosa and Balboa wye fills, \$235,360.42; erection contract payment, \$241,518.38; work in progress, \$2,063,192.12; and other expenses awaiting distribution by divisions, \$1,350,627.79.....	4,421,624.48	
Accounts receivable.....		1,406,156.75
Total disbursements.....		355,589,251.94
Less amounts included above but unpaid on June 30, 1914.....		6,033,418.17
Salaries and wages unpaid on rolls to June 1, 1914.....	234,125.06	
Pay rolls for the month of June, 1914.....	2,195,704.09	
Accounts payable.....	3,603,589.02	
Net disbursements.....		349,555,833.77
Cash balances, June 30, 1914.....		11,365,141.50
Congressional appropriations (Table 7).....	\$11,360,985.18	
Collections due individuals and companies (\$4,289.97) less amount due Panama Railroad from collections repaid to appropriations (\$133.65).....	4,156.32	
Total accounted for.....		360,920,975.27

TABLE 3.—*Statement of appropriations by Congress.*

Canal rights from French company (act of June 28, 1902).....	\$40,000,000.00
Canal Zone rights from Republic of Panama (act of Apr. 28, 1904)...	10,000,000.00
Canal connecting Atlantic and Pacific Oceans.....	21,000,000.00
Act of June 28, 1902.....	\$10,000,000.00
Act of Dec. 21, 1905.....	11,000,000.00
Deficiency for fiscal year 1906 (act of Feb. 27, 1906).....	5,990,786.00
Miscellaneous material purchases in United States.....	\$1,000,000.00
Miscellaneous material purchases on Isthmus..	400,000.00
Payments to Panama Railroad Co.....	200,000.00
Isthmus pay rolls.....	2,100,000.00
Salaries and services in the United States.....	75,000.00
New equipment purchases.....	1,565,786.00
Reequipment of Panama Railroad.....	650,000.00
Total for purchase of rights and for lump-sum appropriations common to all departments.....	76,990,786.00

Expenses in the United States.....		\$1, 847, 235. 69
Salaries.....	\$1, 326, 056. 33	
Incidental expenses.....	521, 179. 36	
Construction and engineering.....		228, 635, 937. 24
Pay of officers and employees.....	27, 029, 212. 00	
Pay of skilled and unskilled laborers.....	94, 809, 961. 00	
Miscellaneous material purchases, etc.....	100, 881, 514. 24	
Incidental expenses on Isthmus.....	5, 915, 250. 00	
Civil administration.....		5, 304, 200. 00
Pay of officers and employees.....	\$4, 007, 000. 00	
Pay of skilled and unskilled laborers.....	191, 000. 00	
Material and expenses.....	1, 106, 200. 00	
Sanitary department.....		13, 295, 335. 15
Pay of officers and employees.....	\$5, 091, 000. 00	
Pay of skilled and unskilled laborers.....	2, 916, 968. 00	
Material and expenses.....	5, 287, 367. 15	
Reequipment of Panama Railroad.....		4, 185, 000. 00
Relocation of Panama Railroad.....		7, 815, 000. 00
Redemption of first-mortgage bonds of Panama Railroad Co.....		2, 298, 367. 50
Sanitation in the cities of Panama and Colon.....		800, 000. 00
Survey of lands, Canal Zone.....		75, 000. 00
Relief of Pembroke B. Banton for injuries.....		10, 000. 00
Total for fiscal years 1907 to 1914, inclusive, less fortifications..		264, 266, 075. 58
Total for canal construction, rights, etc., to June 30, 1914.....		341, 256, 861. 58
Fortifications.....		10, 926, 300. 00
Armament of fortifications.....	\$3, 075, 000. 00	
Seacoast batteries.....	5, 365, 000. 00	
Land for military purposes.....	50, 000. 00	
Surveys for military purposes.....	62, 000. 00	
Causeways.....	150, 000. 00	
Submarine mine structures.....	275, 200. 00	
Field fortifications and camps.....	394, 350. 00	
Manufacture and test of ammunition.....	575, 000. 00	
Submarine mines.....	111, 750. 00	
Electric light and power plants at fortifications.....	173, 000. 00	
Searchlights for seacoast fortifications.....	285, 000. 00	
Sanitary clearing, filling, etc.....	210, 000. 00	
Fire control at fortifications.....	200, 000. 00	
Private acts for relief.....		21, 411. 56
Elizabeth G. Martin, June 17, 1910.....	\$1, 200. 00	
Marcellus Troxell, Jan. 13, 1911.....	1, 500. 00	
W. L. Miles, Feb. 13, 1911.....	1, 704. 18	
Chas. A. Caswell, Mar. 2, 1911.....	1, 056. 00	
Heirs of Robert S. Gill, July 3, 1912.....	2, 520. 00	
Douglas B. Thompson, July 3, 1912.....	1, 500. 00	
Alessandra Comba, July 10, 1912.....	500. 00	
Peter Wiggington, Feb. 7, 1913.....	500. 00	
Raymond R. Ridenour, Feb. 7, 1913.....	500. 00	
Heirs of Chas. E. Stump, Feb. 7, 1913.....	1, 500. 00	
Parents of Edward Maher, Feb. 18, 1913.....	1, 980. 00	
Oscar F. Lackey, Feb. 18, 1913.....	1, 500. 00	
Pedro Sanchez, Feb. 18, 1913.....	2, 000. 00	
John H. Cole, Feb. 18, 1913.....	1, 951. 38	
Robert Coggan, Feb. 18, 1913.....	1, 500. 00	
Judgment of the Court of Claims, War.....		1, 096. 45
Act of Aug. 26, 1912.....	\$196. 45	
Act of Mar. 4, 1913.....	900. 00	
Total appropriations by Congress to June 30, 1914.....		352, 205, 669. 59

TABLE 3.—Statement of appropriations by Congress—Continued.

	Total.	Act of June 30, 1906 (f. y. 1907).	Acts of Mar. 4, 1907, and Feb. 15, 1908 (f. y. 1908).	Acts of May 27, 1908, and Mar. 4, 1909 (f. y. 1909).	Acts of Mar. 4, 1909, and Feb. 25, 1910 (f. y. 1910).	Act of June 25, 1910 (f. y. 1911).	Act of Mar. 4, 1911 (f. y. 1912).	Act of Aug. 24, 1912 (f. y. 1913).	Acts of June 23, 1913, and Apr. 6, 1914 (f. y. 1914).
Expenses in the United States:									
Salaries.....	\$1,326,056.33	\$251,063.33	\$202,600.00	\$149,000.00	\$150,000.00	\$140,000.00	\$130,000.00	\$150,000.00	\$153,393.00
Incidental expenses.....	521,179.36	117,179.36	69,000.00	27,000.00	75,000.00	70,000.00	50,000.00	50,000.00	63,000.00
Construction and engineering:									
Officers and employees.....	27,029,212.00	2,650,512.00	2,982,700.00	4,000,000.00	3,871,000.00	3,900,000.00	3,900,000.00	3,000,000.00	2,725,000.00
Skilled and unskilled laborers.....	94,809,961.00	9,050,661.00	13,526,300.00	10,858,000.00	12,000,000.00	13,500,000.00	16,500,000.00	11,000,000.00	8,375,000.00
Miscellaneous material purchases.....	100,881,514.24	9,032,814.24	15,131,700.00	15,200,000.00	10,517,000.00	15,000,000.00	19,000,000.00	12,000,000.00	5,040,000.00
Incidental expenses on Isthmus.....	5,915,250.00	434,550.00	715,700.00	400,000.00	1,000,000.00	900,000.00	930,000.00	790,000.00	725,000.00
Civil administration:									
Officers and employees.....	4,007,000.00	600,000.00	486,000.00	225,000.00	546,000.00	600,000.00	550,000.00	500,000.00	500,000.00
Skilled and unskilled laborers.....	191,000.00	50,000.00	50,000.00	16,000.00	20,000.00	20,000.00	20,000.00	15,000.00	.....
Material and expenses.....	1,106,200.00	318,200.00	289,000.00	.....	140,000.00	100,000.00	110,000.00	75,000.00	74,000.00
Sanitary department:									
Officers and employees.....	5,091,000.00	550,000.00	766,000.00	700,000.00	725,000.00	600,000.00	600,000.00	700,000.00	450,000.00
Skilled and unskilled laborers.....	2,916,968.00	579,068.00	637,900.00	500,000.00	450,000.00	200,000.00	200,000.00	200,000.00	150,000.00
Material and expenses.....	5,287,367.15	822,367.15	800,000.00	375,000.00	740,000.00	750,000.00	800,000.00	500,000.00	500,000.00
Reequipment of Panama Railroad.....	4,185,000.00	1,000,000.00	1,385,000.00	1,100,000.00	700,000.00	.....	.....	.....	.....
Relocation of Panama Railroad.....	7,815,000.00	.....	.....	1,085,000.00	1,980,000.00	2,000,000.00	2,750,000.00	.....	.....
Redemption of first-mortgage bonds of Panama Railroad Co.....	2,298,367.50	.....	2,298,367.50	.....	.....	.....	.....	.....	.....
Sanitation, Panama and Colon.....	800,000.00	.....	.....	.....	800,000.00	.....	.....	.....	.....
Survey of lands, Canal Zone.....	75,000.00	.....	.....	.....	.....	75,000.00	.....	.....	.....
Pembroke B. Banton for injuries.....	10,000.00	.....	.....	10,000.00	.....	.....	.....	.....	.....
Total regular fiscal-year appropriations.....	244,103,175.58	25,456,415.08	27,161,367.50	29,187,000.00	33,638,000.00	37,855,000.00	45,560,000.00	28,980,000.00	16,265,393.00
Total deficiency appropriations.....	20,162,900.00	.....	12,178,900.00	5,458,000.00	76,000.00	.....	.....	.....	2,450,000.00
Total for fiscal years 1907 to 1914, inclusive, less forfeitures.....	264,266,075.58	25,456,415.08	39,340,267.50	34,645,000.00	33,714,000.00	37,855,000.00	45,560,000.00	28,980,000.00	18,715,393.00

NOTE.—The appropriations made primarily for fiscal years were made available until expended, and for 1912, 1913, and 1914 were made immediately available. By an act approved Aug. 1, 1914, the following appropriations were made available for canal purposes for the fiscal year 1915:

In the United States:		
Salaries.....	\$150,000.00	
Incidental expenses.....	62,000.00	
Construction and engineering:		
Pay of officers and employees.....	2,414,000.00	
Pay of skilled and unskilled laborers.....	7,000,000.00	
Miscellaneous material purchases, etc.....	9,000,000.00	
Incidental expenses on Isthmus.....	725,000.00	
Civil administration:		
Pay of officers and employees.....	500,000.00	
Material and expenses.....	72,000.00	
Sanitary department:		
Pay of officers and employees.....	300,000.00	
Pay of skilled and unskilled laborers.....	120,000.00	
Material and expenses.....	375,000.00	
Total for canal work, fiscal year 1915.....	20,718,000.00	
Fortifications:		
Electric light and power plants.....		\$33,550.00
Buildings and material.....		57,375.00
Toro Point—		
Concrete storehouse.....		\$5,000.00
Ten buildings.....		9,000.00
Miraflores or Gatun, storehouse.....		5,000.00
Obstacles.....		7,575.00
Telephone line.....		30,800.00
Maintenance of clearings and trails.....		21,900.00
Clearings.....		21,000.00
Trails.....		900.00
Armament of fortifications (ammunition).....		233,000.00
Seacoast artillery.....		26,000.00
Submarine mine structures.....		2,700.00
Fire control.....		50,000.00
Barracks and quarters.....		700,000.00
Total for fortifications fiscal year 1915.....		1,124,525.00

TABLE 4.—*Detailed statement of collections which have been deposited in the United States Treasury as miscellaneous receipts and lost to canal appropriations to June 30, 1914.*

	Current year.	Total to date.
Sales of Panama Canal property.....		\$1, 388, 277. 57
Sale of property.....	\$208, 845. 75	\$1, 059, 345. 86
Sale of French material and equip- ment.....	13, 968. 79	95, 603. 59
Sale of water.....		255. 43
Sale of Panama Railroad stock.....		1, 300. 00
Mess accounts.....		46, 879. 48
Receipts from pay patients.....		79, 992. 68
Quarantine subsistence.....		24, 900. 53
Sale of Panama Canal building, city of Panama.....	80, 000. 00	80, 000. 00
Rentals of Panama Canal property.....		615, 949. 59
Rent of lands and buildings.....		41, 427. 24
Rent of equipment.....		311, 047. 33
Panama water and sewer rentals.....	51, 301. 65	123, 269. 36
Colon water and sewer rentals.....	43, 206. 92	74, 779. 92
Rentals, miscellaneous.....		65, 425. 74
Work done by Panama Canal.....		207, 786. 52
Labor furnished Panama Railroad Co.....		180, 336. 97
Other labor furnished.....		27, 449. 55
Miscellaneous.....		3, 065, 365. 69
Telegraph and telephone service.....		3, 547. 35
Hotels and boarding camps.....		758, 470. 34
Hotel coupon books.....		32, 238. 28
Laundry receipts.....		7, 382. 01
Corral receipts.....		8, 628. 56
Miscellaneous.....		93, 740. 47
Interest on loans.....		473, 194. 27
Repayment of loans.....		1, 687, 714. 92
Pay-car overages.....	37. 91	449. 49
Subsidies and dividends.....		976, 820. 00
Annual subsidy from Panama Railroad Co.....		631, 875. 00
Dividends on Panama Railroad stock.....		344, 945. 00
Tolls.....	4. 00	4. 00
Total.....		6, 254, 203. 37

TABLE NO. 5.—*Detailed statement of classified expenditures for the fiscal year ending June 30, 1914, and total from the beginning of the work to date.*

	Total fiscal year 1914.	Total to June 30, 1914.
Civil government and law:		
Administration.....	\$51, 149. 11	\$656, 977. 20
Supreme and circuit courts.....	31, 759. 28	396, 429. 00
Prosecuting attorney.....		39, 558. 47
Division of revenues.....	11, 459. 46	196, 019. 21
Division of posts.....	113, 814. 52	846, 424. 08
Division of customs.....	13, 028. 45	88, 853. 79
Division of lands and buildings.....		102, 046. 07
Division of estates.....	3, 703. 39	33, 601. 04
Police and prisons.....	262, 830. 81	2, 525, 523. 86
Fire protection.....	96, 557. 71	892, 311. 04
Maintenance and operation of water works and sewers—		
Panama.....	74, 953. 06	243, 701. 96
Colon.....	60, 341. 42	313, 276. 82
Repairs and maintenance of pavements—		
Panama.....	29, 516. 19	70, 756. 71
Colon.....	8, 531. 47	55, 490. 04
Miscellaneous Zone public works.....	707. 56	34, 150. 52
Treasurer of the Canal Zone.....	5, 679. 25	52, 944. 05
Construction of buildings.....	7. 48	514, 526. 89
Repairs of buildings.....	5, 317. 88	25, 075. 05
Survey of Canal Zone lands.....		75, 000. 09
Office of counsel and chief attorney, special attorney.....	15, 491. 10	52, 145. 21
Land office.....	1, 088. 18	9, 419. 34

TABLE NO. 5.—*Detailed statement of classified expenditures for the fiscal year ending June 30, 1914, and total from the beginning of the work to date—Continued.*

	Total fiscal year 1914.	Total to June 30, 1914.
Civil government and law—Continued.		
District court.....	\$3,349.14	\$3,349.14
District attorney.....	2,089.64	2,089.64
Canal Zone marshal.....	1,687.97	1,687.97
	793,066.10	7,231,357.10
Less amount pro rated to—		
Cost of work done for and sales to private persons.....	8,011.99	8,011.99
Operation and maintenance of canal.....	5,940.58	5,940.58
Total, civil government and law.....	779,113.53	7,217,404.53
Health department:		
Administration.....	42,485.37	888,719.22
Hospitals and asylums—		
Medical storehouse, Colon.....	7,437.98	48,536.77
Ancon hospital.....	330,707.80	4,011,177.26
Colon hospital.....	59,736.68	1,965,410.32
Taboga sanitarium.....	6,081.19	131,428.43
Santo Tomas hospital.....	11,948.16	72,447.82
Other hospitals, dispensaries, and sick camps.....	129,311.13	2,185,540.34
Quarantine.....	41,247.69	407,668.64
Sanitation, Panama and Colon—		
Sanitation proper, Panama.....	40,471.99	846,537.77
Disposal of garbage, street cleaning, etc., Panama.....	14,328.39	92,957.69
Sanitation proper, Colon.....	26,395.34	635,430.85
Disposal of garbage, street cleaning, etc., Colon.....	8,678.87	47,671.15
Zone sanitation—		
Sanitation proper.....	230,166.64	4,246,233.93
Disposal of garbage, street cleaning, etc.....	50,831.24	537,004.86
Construction of buildings.....	3,945.81	1,037,745.06
Repairs of buildings.....	16,764.22	110,726.46
Corozal farm.....	10,331.57	15,798.43
	1,030,870.07	17,281,035.00
Less amount pro rated to—		
Cost of work done for and sales to private persons.....	10,540.01	10,540.01
Operation and maintenance of canal.....	10,697.69	10,697.69
Total, health department.....	1,009,632.37	17,259,797.30
Department of construction and engineering:		
Atlantic district—		
Dry excavation (prism), construction work.....	76.30	1,483,709.72
Dredging excavation (prism)—		
Construction work.....	642,429.95	9,076,914.85
Plant.....	¹ 120,440.23	¹ 27,067.21
Gatun dam and spillway—		
Construction work.....	328,331.68	12,205,938.44
Plant.....	¹ 120,996.50	¹ 416,444.07
Gatun locks—		
Construction work.....	1,851,830.34	30,004,213.49
Plant.....	¹ 89,214.86	109,036.36
Gatun power plant, permanent—		
Construction work.....	310,189.84	674,292.69
Plant.....	2,012.47	4,208.01
Rock and sand account—		
Porto Bello rock plant.....	¹ 168,533.48	17,093.84
Transportation plant.....	¹ 347,457.97	¹ 41,591.68
Colon breakwater—		
Construction work.....	1,452,812.29	4,089,056.40
Plant.....	156,183.17	163,124.20
Gatun-Mindi levee.....	46,536.84	119,005.31
Terminal facilities, Cristobal—		
Construction work.....	470,669.10	485,157.24
Plant.....	35,270.51	35,270.51
Clearing channel in Gatun Lake.....	¹ 7,697.85	¹ 2,014.58
Trinidad River dam, construction work.....	37,810.65	37,810.65
Total, Atlantic district.....	4,479,812.25	58,017,714.17
Central district—		
Dry excavation—		
Construction work.....	2,008,900.13	86,012,107.67
Plant.....	¹ 63,741.82	¹ 116,837.53
Dredging excavation—		
Construction work.....	2,433,800.45	2,454,293.78
Plant.....	701,782.59	711,026.33

TABLE NO. 5.—*Detailed statement of classified expenditures for the fiscal year ending June 30, 1914, and total from the beginning of the work to date—Continued.*

	Total fiscal year 1914.	Total to June 30, 1914.
Department of construction and engineering—Continued.		
Central district—Continued.		
Clearing channel in Gatun Lake.....	\$7,799.96	\$157,151.18
Masonry—		
Construction work.....		12,432.77
Plant.....	¹ 1,600.00	
Total, central district.....	5,086,941.31	89,230,174.20
Pacific district—		
Dry excavation (prism)—		
Construction work.....	186,093.42	3,511,930.46
Plant.....	¹ 157,238.33	¹ 94,618.98
Dredging excavation (prism)—		
Construction work.....	964,961.15	11,485,691.75
Plant.....	¹ 107,497.14	637,027.88
Pedro Miguel locks and dams—		
Construction work.....	1,795,940.46	13,441,556.31
Plant.....	1,128.53	24,123.65
Miraflores locks and dams—		
Construction work.....	3,632,700.57	21,797,177.67
Plant.....	¹ 98,564.54	¹ 23,495.58
Rock and sand account—		
Ancon rock plant.....	¹ 133,463.86	¹ 24,417.18
Chame sand plant.....	¹ 11,478.19	¹ 7,724.95
Miraflores power plant, construction work.....	34,124.36	208,609.96
Naos Island breakwater, construction work.....	446,237.31	851,338.19
Terminal facilities, Balboa—		
Construction work.....	5,400,669.47	7,264,838.59
Plant.....	¹ 126,724.97	134,175.77
Total, Pacific district.....	11,826,888.24	59,206,213.64
General:		
Aids to navigation—		
Construction work.....	190,181.44	560,666.52
Plant.....	4,058.42	30,941.27
Permanent town sites, construction work.....	720,624.39	720,624.39
Permanent buildings—		
Construction work.....	1,526,363.01	1,590,252.30
Plant.....	16,075.87	21,349.06
Electric transmission line—		
Construction work.....	1,902,367.80	1,916,383.43
Plant.....	¹ 630.54	752.36
Permanent oil pipe line, construction.....	¹ 32,054.69	
Total, general.....	4,326,985.70	4,840,969.33
General items:		
Hotels, messes and kitchens, operations.....	¹ 4,610.07	¹ 104,232.32
Hotel equipment.....	14,357.58	61,146.63
Hotel, incidental expenses.....	12,110.15	51,917.12
Hotel Tivoli.....	¹ 19,243.59	¹ 175,577.55
Hotels, messes and kitchens, alterations and improvements.....	27,213.60	141,569.58
Lands purchased—		
For construction work or to be flooded.....	111,237.63	552,624.93
For other purposes.....	158,723.08	312,141.93
Joint land commission.....	321,388.70	343,844.70
Cristobal terminals—		
Docks and wharves.....	¹ 6,076.54	232,595.06
Dredging.....		84,773.74
Balboa terminals, docks and wharves.....	¹ 6,215.75	160,887.07
Panama Railroad second main track.....	44.29	1,123,522.22
Relocation of Panama Railroad—		
Construction work.....	286,311.17	8,942,372.37
Maintenance.....	663.75	118,200.75
Plant.....	¹ 500.00	210,606.28
Purchase, improvement, and repair of steamers—		
Panama.....		655,942.48
Colon.....		579,812.22
Cristobal.....		716,085.43
Ancon.....		728,271.88
Construction of buildings, department of construction and engineering.....	¹ 8,157.67	9,611,827.29
Alteration and repair of buildings, department of construction and engineering.....	115,289.32	783,490.73
Purchase from New Panama Canal Co.....		40,000,000.00
Payment to Republic of Panama.....		10,000,000.00
Loans to Panama Railroad Co.....		3,247,332.11
Purchase of Panama Railroad stock.....		157,118.24

¹ Credit.

TABLE NO. 5.—*Detailed statement of classified expenditures for the fiscal year ending June 30, 1914, and total from the beginning of the work to date—Continued.*

	Total fiscal year 1914.	Total to June 30, 1914.
General Items—Continued.		
Construction of waterworks and sewers—		
Panama.....	\$1,505.37	\$682,563.28
Colon.....	3,955.63	616,268.99
Zone waterworks and sewers—		
Construction—		
Zone proper.....	74,893.05	3,376,001.79
Panama system.....		490,073.45
Colon system.....	124,300.01	644,364.89
Ancon filtration plant.....		19,816.33
Permanent supply.....	764,215.55	776,857.30
Maintenance.....	344,128.42	1,585,635.68
Paving Panama.....		577,718.28
Paving Colon.....	10,347.34	534,938.72
Zone roadways—		
Construction work.....	25,695.21	1,438,798.79
Repairs and maintenance.....	54,106.37	261,482.83
Miscellaneous grading and other municipal work.....		4,142.62
Moving and care of French material and equipment.....		2,833.23
Plant in Panama Railroad service.....	101,987.18	789,506.65
Permanent plant.....	¹ 310.10	36,987.66
Total, general items.....	2,507,359.68	90,374,263.38
Fortifications—		
Atlantic—		
Seacoast batteries, emplacement.....	613,386.82	1,612,841.96
Fire control.....	213.98	213.98
Submarine mines structures.....	109,502.05	116,184.79
Plant.....	3,477.83	10,806.27
Total, Atlantic fortifications.....	726,580.68	1,740,047.00
Pacific—		
Seacoast batteries, emplacement.....	945,074.24	1,986,687.25
Power plants.....	15,260.01	15,260.01
Searchlights.....	61.65	61.65
Fire control.....	4,763.56	4,763.56
Submarine mines structures.....	74,865.09	78,836.97
Causeway.....	20,135.23	64,699.01
Plant.....	¹ 31,297.65	8,207.72
Total, Pacific fortifications.....	1,028,862.13	2,158,516.17
Land defenses and barracks—		
Surveys.....	17,377.67	46,069.10
Field fortifications and camps.....	183,351.27	196,450.79
Total, land defenses and barracks.....	200,728.94	242,519.89
Guns and ammunition—		
Armaments to fortifications.....	1,667,299.51	2,596,745.72
Ammunition.....	903.62	903.62
Submarine mines material.....	54,357.33	54,357.33
Total, guns and ammunition.....	1,722,560.46	2,652,006.67
Total, fortifications.....	3,678,732.21	6,793,089.73
Grand total.....	33,695,465.29	332,939,626.28

¹ Credit.

Expenditure accounts for the fiscal year ending June 30, 1914, which have been charged to departments and divisions for distribution to canal construction accounts.

Administration:

General administrative expenses (9 months).....	\$218,438.59
Miscellaneous general expenses on the Isthmus (9 months).....	384,156.00
General bureau (3 months).....	23,982.60
Time-keeping bureau (3 months).....	23,307.43
Cost-keeping bureau (3 months).....	11,857.67
Bureau of clubs and playgrounds (9 months).....	47,869.18
Miscellaneous bureau (3 months).....	6,111.15
Operation of official motor cars (3 months).....	3,905.88

Administration—Continued.

Engineer of maintenance (3 months).....	\$13,785.49
Miscellaneous (3 months).....	32,821.32
Meteorology and hydrography (3 months).....	2,916.26
In the United States:	
Miscellaneous general expenses (9 months).....	100,828.40
Purchasing expenses (12 months).....	171,881.61
Inspection expenses (12 months).....	71,628.97
Assistant auditor (12 months).....	23,704.23
Disbursing clerk (12 months).....	29,866.91
Accounting department:	
Auditor (12 months).....	187,296.27
Paymaster (12 months).....	62,102.05
Collector (3 months).....	5,556.90
Canal record (12 months).....	23,227.83
Transportation on the Isthmus:	
Freight (12 months).....	501,000.00
Passenger (12 months).....	118,848.00
Compensation to injured employees (12 months).....	171,892.76
Telegraph and telephones (12 months).....	76,182.13
Operation of stores (12 months).....	650,489.82
Recruiting (12 months).....	186,451.20
Quarters (12 months).....	369,722.28
Construction of buildings, department of construction and engineering (12 months).....	19,096.73
Alteration and repair of buildings, department of construction and en- gineering (12 months).....	12,881.69
Operation of docks and wharves:	
By the Panama Railroad (12 months).....	42,051.67
By The Panama Canal (12 months).....	1,287.74
Total.....	3,595,148.76

TABLE 6.—Statement of plant and equipment purchased for and absorbed in construction work to June 30, 1914.

Construction and engineering.	Debits.			Credit by arbitraries charged to work.			Balance to be absorbed after June 30, 1914.
	Plant charge to June 30, 1913.	Fiscal year 1914.	Total plant charges.	Arbitraries applied to June 30, 1913.	Fiscal year 1914.	Total arbitraries applied.	
ATLANTIC.							
Dry excavation.....	\$267,790.49	.....	\$267,790.49	\$267,790.49	.....	\$267,790.49	.....
Dredging excavation.....	2,176,347.39	\$31,427.79	2,207,775.18	2,082,974.37	\$151,868.02	2,234,842.39	1,827,067.21
Gatun dam and spillway.....	1,395,169.54	2107,698.70	1,287,470.84	1,690,617.11	13,297.80	1,703,914.91	1416,444.07
Gatun locks.....	2,562,627.24	251,065.75	2,511,561.49	2,600,174.75	8,791.64	2,608,966.39	197,404.90
Porto Bello rock.....	1,260,763.12	9,723.40	1,270,486.52	1,075,135.80	178,256.88	1,253,392.68	17,093.84
Nombre de Dios sand.....	1,443,583.39	.....	443,583.39	443,583.39	.....	443,583.39	.....
Transportation.....	1,866,441.78	262,181.60	1,804,260.18	1,560,575.49	285,276.37	1,845,851.86	141,591.68
Colon breakwater.....	212,792.14	153,356.23	366,148.37	205,851.11	12,826.94	203,024.17	163,124.20
Terminal facilities, Cristobal.....	.....	35,270.51	35,270.51	.....	.....	.....	35,270.51
CENTRAL.							
Dry excavation.....	10,144,020.03	263,741.82	10,080,278.21	10,197,115.74	.....	10,197,115.74	1116,837.53
Dredging excavation.....	9,243.74	1,046,239.75	1,055,483.49	.....	344,457.16	344,457.16	711,026.33
Masonry.....	1,600.00	21,600.00	.....	.....	.....	.....	.....
PACIFIC.							
Dry excavation.....	521,675.59	286,697.33	434,978.26	459,056.16	70,541.00	529,597.16	194,618.90
Dredging excavation.....	3,817,938.25	21,463.88	3,839,402.13	3,073,413.23	128,961.02	3,202,374.25	637,027.88
Pedro Miguel locks and dams.....	879,183.90	.....	879,183.90	898,614.94	3,502.60	902,117.54	122,933.64
Miraflores locks and dams.....	1,440,916.43	257,889.95	1,383,026.48	1,439,820.59	40,674.59	1,480,495.18	197,468.70
Ancon rock.....	887,818.26	5,673.19	893,491.45	773,771.58	139,137.05	917,908.63	124,417.18
Chame sand.....	326,146.20	26,447.56	319,698.64	322,392.96	5,030.63	327,423.59	17,724.95
Miraflores power plant.....	508,982.90	127,566.24	636,549.14	334,497.30	93,441.88	427,939.18	208,609.96
Terminal facilities, Balboa.....	381,150.97	119,066.83	500,217.80	120,250.23	245,791.80	366,042.03	134,175.77
GENERAL.							
Hydroelectric plant.....	2,195.54	2,012.47	4,208.01	.....	.....	.....	4,208.01
Operating-machinery installation:							
Gatun.....	235,798.73	229,357.47	206,441.26	.....	.....	.....	206,441.26
Pedro Miguel.....	42,426.16	4,631.13	47,057.29	.....	.....	.....	47,057.29
Miraflores.....	73,973.12	.....	73,973.12	.....	.....	.....	73,973.12
Lighting and buoying the canal.....	26,882.85	4,058.42	30,941.27	.....	.....	.....	30,941.27
Permanent buildings.....	5,273.19	54,364.19	59,637.38	.....	.....	.....	21,349.06
Construction of electric-transmission line.....	1,382.90	30,630.59	32,013.49	.....	.....	.....	752.36
Total construction and engineering.....	29,492,123.85	1,178,804.44	30,670,928.29	27,550,635.24	1,775,750.95	29,326,386.19	1,344,542.10

¹ Arbitrarities in excess of plant charges to be adjusted.² Credit by transfers.

TABLE 6.—Statement of plant and equipment purchased for and absorbed in construction work to June 30, 1914—Continued.

	Debits.			Credit by arbitraries charged to work.			Balance to be absorbed after June 30, 1914.
	Plant charge to June 30, 1913.	Fiscal year 1914.	Total plant charges.	Arbitraries applied to June 30, 1913.	Fiscal year 1914.	Total arbitraries applied.	
Construction and engineering.							
SEACOAST BATTERIES.							
Atlantic.....	\$55,554.98	\$9,355.23	\$64,910.21	\$48,226.54	\$5,877.40	\$54,103.94	\$10,806.27
Pacific.....	79,676.20	6,519.39	86,195.59	40,170.83	37,817.04	77,987.87	8,207.72
MISCELLANEOUS PLANT NOT CREDITED BY ARBITRARIES.							
Relocation of Panama R. R.....	211,106.28	.....	211,106.28	.....	.....	.....	.....
Plant loaned to Panama R. R.....	687,519.47	.....	687,519.47	.....	.....	.....	.....
Purchase, improvement, and repair of steamers:							
Panama (less rentals).....	655,942.48	.....	655,942.48	.....	.....	.....	.....
Colon (less rentals).....	579,812.22	.....	579,812.22	.....	.....	.....	.....
Cristobal.....	716,058.43	.....	716,058.43	.....	.....	.....	.....
Aneon.....	728,271.88	.....	728,271.88	.....	.....	.....	.....
Permanent shops.....	37,297.76	.....	37,297.76	.....	.....	.....	.....
Total.....	.....	.....	34,438,042.61	.....	.....	.....	.....

NOTE.—This statement does not include docks and wharves, construction of buildings, waterworks and sewers, pavements and roads.

TABLE 7.—Statement of receipts and disbursements from appropriations for fiscal year ending June 30, 1914.

	Balance brought forward July 1, 1913.	Act of June 23, 1913.	Act of Apr. 6, 1914.	Collections repaid appropriations during fiscal year.	Transfers between Canal appropriations on charges rendered between departments.	Total available during the year.	Disbursements.	Cash balance June 30, 1914.
In the United States:								
Salaries.....	\$12,958.62	\$153,393.00	.....	\$3,012.35	.....	\$169,363.97	\$164,277.09	\$5,086.88
Incidentals.....	5,003.31	63,000.00	.....	1,831.49	\$6,300.00	76,134.80	63,043.30	13,091.50

TABLE 8.—Statement of United States funds disbursed on the Isthmus during fiscal year ending June 30, 1914.

Months.	Gold rolls.	Silver rolls.	Public bills and reimbursement vouchers.	Total.	Items on rolls each month.		
					Gold.	Silver.	Total.
1913.							
July.....	\$811,978.42	\$1,018,141.45	\$783,375.86	\$2,613,445.73	\$5,187	\$37,388	\$42,575
August.....	721,651.06	1,056,586.16	893,035.10	2,671,332.32	5,155	38,502	43,657
September.....	750,350.80	1,036,355.00	761,658.96	2,608,364.76	5,003	40,084	45,030
October.....	772,146.17	998,132.30	821,857.01	2,592,135.48	5,183	39,134	44,317
November.....	755,036.25	983,135.78	736,878.51	2,475,050.54	4,860	37,325	42,185
December.....	679,273.56	816,669.01	599,684.76	2,035,627.33	4,753	34,125	38,878
1914							
January.....	688,093.65	853,148.10	704,936.95	2,246,178.70	4,357	34,188	38,545
February.....	681,499.34	847,646.52	596,655.78	2,125,801.64	4,665	34,212	38,877
March.....	731,913.99	762,992.00	728,214.74	2,223,120.73	4,787	31,324	37,111
April.....	635,735.00	803,414.84	597,453.06	2,036,602.90	4,833	32,883	37,716
May.....	709,441.16	759,556.98	595,893.83	2,055,891.97	5,579	31,228	36,807
June.....	700,682.59	719,792.69	585,101.31	2,005,583.59	5,414	30,115	35,529
Total.....	8,628,808.99	10,715,570.83	8,404,755.87	27,749,135.69	59,779	421,508	481,287

TABLE 9.—Statement of cash shipments received by the paymaster during the fiscal year ending June 30, 1914, to meet disbursements on Isthmus.

September, 1913:	
Twenty dollar gold pieces.....	\$400,000.00
One dollar bills.....	30,000.00
Two dollar bills.....	50,000.00
Fifty dollar bills.....	5,000.00
One hundred dollar bills.....	5,000.00
Five hundred dollar bills.....	10,000.00
Total.....	500,000.00
February, 1914:	
Five dollar gold pieces.....	50,000.00
Ten dollar gold pieces.....	50,000.00
Twenty dollar gold pieces.....	400,000.00
Total.....	500,000.00
May, 1914:	
Ten dollar bills.....	100,000.00
Twenty dollar bills.....	400,000.00
Fifty dollar bills.....	100,000.00
One hundred dollar bills.....	100,000.00
Total.....	700,000.00

TABLE 10.—*Detailed statement of collections repaid to appropriations during the fiscal year ending June 30, 1914.*

Nature of collections.	July 1, 1913, to Mar. 31, 1914, inclusive.	Apr. 1, 1914, to June 30, 1914, inclusive.	Total fiscal year 1914.
General construction and repairs.....	\$154,808.38	\$99,052.46	\$253,860.84
Dredging.....	31,234.31	11,195.87	42,430.18
Launches, clapets, and barges.....	2,638.98	263.27	2,902.25
Shop manufacture and repairs.....	201,700.19	164,671.11	366,371.30
Cristobal dry docks.....	82.00	68.00	150.00
Sales of electric current.....	53,899.75	18,725.72	72,625.47
Installation and maintenance electrical equipment.....		716.55	716.55
Sales of compressed air.....	450.23	289.51	739.74
Locomotives, cranes, and wreckers.....	10,401.94	4,317.45	14,719.39
Labor trains and train service.....	4,037.72	11.26	4,048.98
Rental of commercial docks.....	12,135.25	3,897.75	16,033.00
Wharfage.....	7,787.50		7,787.50
Overpayments on pay rolls.....		35.66	35.66
Lost property.....		117.77	117.77
Zone water rentals.....	4,510.16	1,062.13	5,572.29
Hostling.....		284.86	284.86
Towage.....	7,836.16	11,933.32	19,769.48
Pilotage.....		1,370.00	1,370.00
Miscellaneous.....	11,569.55	1,417.90	12,987.45
Sales of photographs and prints.....	526.51	271.67	798.18
Issuing commissary books (Panama R. R.).....	36,942.55		36,942.55
Proportion of salaries.....		8,093.07	8,093.07
Balance of collections for fiscal year 1913 repaid to appropriations February, 1914.....	303,278.76		303,278.76
Total.....	843,839.94	327,795.33	1,171,635.27
Subsistence:			
Receipts from hotels, messes, and kitchens and sales of hotel books and meal tickets.....	976,968.90	271,641.29	1,248,610.19
Proportion salaries, commissary, and subsistence.....		521.39	521.39
Miscellaneous.....		2,735.63	2,735.63
Total.....	976,968.90	274,898.31	1,251,867.21
Quartermaster:			
Sales of material and supplies.....	1,101,912.52	293,807.16	1,395,719.68
Sales of rock, sand, gravel, and screenings.....	52,445.55	9,014.90	61,460.45
Rental of buildings.....	4,508.26	10,568.92	15,077.18
Printing and binding.....	4,585.22	571.10	5,156.32
Corral service.....	75,335.42	13,765.62	89,101.04
Purchasing and handling supplies.....	54,511.99	21,070.66	75,582.65
Repair jobs.....		51,347.67	51,347.67
Overpayment on pay rolls.....		2.16	2.16
Transportation (deportation of insane).....		80.44	80.44
Expense of making sales.....	39,045.09	10,909.91	49,955.00
Miscellaneous.....	23,733.22	4,369.20	28,102.42
Miscellaneous refunds.....		7,159.24	7,159.24
Total.....	1,356,077.27	422,666.98	1,778,744.25
Civil government:			
Police service.....	13,553.71	4,058.32	17,612.03
Proportion land-office expense, Panama R. R.....	7,200.00	2,000.00	9,200.00
Legal services.....	200.00	400.00	600.00
Sales of material.....	348.86	9.14	358.00
Gamboa prison mess.....		7.75	7.75
Reimburse, proportion postal receipts.....		20,000.00	20,000.00
Water rentals:			
Panama.....	48,398.00	34,945.60	83,343.60
Colon.....	31,602.00	24,040.44	55,642.44
Miscellaneous.....	834.35	47.50	881.85
Refunds.....		403.68	403.68
	102,136.92	85,912.43	188,049.35
Accounting:			
Lost metal checks.....	2,875.50	891.90	3,767.40
Proportion of salaries.....	5,050.00	5,512.12	10,562.12
Total.....	7,925.50	6,404.02	14,329.52

TABLE 10.—*Detailed statement of collections repaid to appropriations during the fiscal year ending June 30, 1914—Continued.*

Nature of collections.	July 1, 1913, to Mar. 31, 1914, inclusive.	Apr. 1, 1914, to June 30, 1914, inclusive.	Total fiscal year 1914.
Health department:			
Sales of material and supplies.....	\$9,408.77	\$1,837.74	\$11,246.51
Material surcharges.....	202.49		202.49
Labor (including salvage from dump).....	6,842.17	214.65	7,056.82
Surcharges and supervision.....	873.38		873.38
Hospital service.....	138,034.79	38,783.07	176,817.86
Medical service.....	2,735.50	1,362.05	4,097.55
Hospital messes.....	13,112.70	2,381.36	15,494.06
Hospital laundry.....	14,881.69	4,867.87	19,749.56
Quarantine subsistence.....	12,966.22	4,041.18	17,007.40
Quarantine transportation.....	1,065.64	330.30	1,395.94
Taboga sanitarium.....	8,524.42		8,524.42
Palo Seco leper asylum.....	4,710.25	2,006.75	6,717.00
Services rendered by other departments.....	1,790.74		1,790.74
Corozal farm sales.....	1,395.66	1,198.11	2,593.77
Telephone (service of operators).....	511.00		511.00
Burials.....		1,023.66	1,023.66
Cleaning premises.....		1,898.68	1,898.68
Cleaning streets, Republic of Panama.....		28,788.60	28,788.60
Miscellaneous.....		432.27	432.27
Total.....	217,055.42	89,166.29	306,221.71
Expenses in United States, miscellaneous.....	3,293.02	1,135.30	4,428.32
Armament of fortifications.....		2,748.67	2,748.67
Total repaid to appropriations.....	3,507,296.97	1,210,727.33	4,718,024.30
The following collections were deposited in the United States Treasury as miscellaneous receipts:			
Sale of property.....			208,845.75
Sale of old Panama Canal building.....			80,000.00
Sale of French scrap.....			13,968.79
Water rentals—Panama and Colon.....			94,508.57
Pay car overages.....			37.91
Tolls.....			4.00
Grand total collections.....			5,115,389.32

TABLE 11.—Statement of collections made on Panama Canal pay rolls during fiscal year ended June 30, 1914.

Months.	Total.	Commissary coupon books.	Hotel coupon books.	Subsistence.	Lost metal checks.	Transportation.	Medical service.	Bills collectible.	Miscellaneous.
GOLD ROLLS.									
1913—July.....	\$113,612.23	\$75,045.00	\$31,186.72	\$2.30	\$17.50	\$30.00	\$3,115.95	\$792.34	\$3,422.42
August.....	112,905.88	74,755.00	31,529.94	3.85	18.00	80.00	2,588.42	537.85	3,392.82
September.....	112,318.82	75,032.45	32,144.48	1.65	17.50	120.00	3,080.83	421.48	1,500.43
October.....	106,128.46	69,841.20	30,608.32	.....	18.00	.....	2,809.59	199.59	2,651.76
November.....	96,153.24	62,885.00	28,783.80	.....	18.50	90.00	2,555.27	268.06	1,552.61
December.....	75,177.13	45,540.00	25,198.80	3.10	14.50	110.00	2,682.97	240.57	1,387.19
1914—January.....	84,162.02	55,209.52	25,203.93	78.30	12.00	50.00	2,121.00	247.06	1,240.21
February.....	81,477.29	50,380.00	26,648.67	8.73	13.00	30.00	2,421.48	253.67	1,721.74
March.....	76,969.70	48,030.93	25,440.00	.10	16.50	.....	2,200.51	216.89	1,064.77
April.....	77,024.40	48,616.90	25,920.60	5.50	14.00	.....	1,497.27	72.75	897.38
May.....	75,755.05	46,268.10	27,193.80	4.00	19.50	.....	2,076.49	79.34	1,113.82
June.....	72,942.64	42,330.00	27,550.80	34.66	14.50	.....	1,721.10	80.40	1,211.18
Total.....	1,084,626.86	692,934.10	337,409.86	142.19	193.50	510.00	28,870.88	3,410.00	21,156.33
SILVER ROLLS.									
1913—July.....	238,025.13	203,791.76	54.60	32,799.43	306.00	.....	485.44	4.90	583.00
August.....	246,171.62	207,761.72	88.80	36,600.80	318.50	.....	769.10	2.59	630.11
September.....	237,228.03	215,773.86	144.00	39,182.48	352.50	4.10	1,182.52	.....	588.57
October.....	241,838.17	204,322.27	128.40	35,522.06	309.50	.....	934.42	.....	621.52
November.....	230,372.94	194,638.70	188.40	33,793.59	320.00	29.00	1,007.02	.....	396.23
December.....	208,545.48	179,286.35	138.00	27,359.74	287.00	.....	932.01	.....	542.38
1914—January.....	234,333.19	207,776.97	198.60	25,033.94	284.50	.....	637.82	.71	400.65
February.....	204,009.78	179,123.30	163.80	23,201.45	307.00	.....	803.87	.....	410.36
March.....	189,278.36	168,527.62	159.60	19,446.06	251.50	.....	546.10	.....	347.48
April.....	197,770.72	175,805.64	109.80	20,617.81	287.00	.....	730.60	.43	219.44
May.....	194,257.24	172,914.02	90.00	19,907.29	259.50	.....	673.16	.....	412.67
June.....	178,456.15	158,501.00	94.20	18,848.64	237.90	.....	571.87	.....	202.54
Total.....	2,620,286.81	2,268,223.81	1,558.20	332,313.29	3,520.90	33.10	9,273.93	8.63	5,354.95
Grand total of collections.....	3,704,913.67	2,961,157.91	338,968.06	332,455.48	3,714.40	543.10	38,144.81	3,418.63	26,511.28
Collected for Panama R. R. Co. and various individuals.....	2,972,432.53	2,961,157.91	.....	.....	.....	.....	.....	.....	11,274.62
Returnable to appropriations (Table 10).....	732,481.14	.....	338,968.06	332,455.48	3,714.40	543.10	38,144.81	3,418.63	15,236.66

TABLE 12.—Statement of audited pay rolls on Isthmus during fiscal year 1914.

	Total pay rolls.	Officers and employees.		Skilled and unskilled labor. ¹		Seacoast batteries.		Miscellaneous material purchases. ¹		Canal connecting Atlantic and Pacific Oceans. ²	
		Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Construction and engineering.....	\$11,363,855.42	\$2,583,186.77	22.73	\$8,705,023.38	76.60						
Fortifications division.....	878,520.28										
Mechanical and electrical divisions.....	3,092,964.02	358,340.46	11.59	2,734,623.56	88.41	\$878,520.28	100.00	\$47,938.75	0.42	\$27,706.52	0.24
Supply department:											
Quartermaster.....	2,330,666.69	658,379.62	28.25	1,672,287.07	71.75						
Su sistence.....	207,479.26	83,195.12	40.10	124,284.14	59.90						
Auditor.....	222,416.24	222,144.92	99.88	271.32	.12						
Paymaster.....	58,223.69	58,223.69	100.00								
Personal-injury claims.....	158,856.24	13,647.72	8.59	137,081.73	86.29	7,911.79	4.98	215.00	.14		
Total construction and engineering.....	18,312,981.84	3,977,118.30	21.72	13,373,571.20	73.03	886,432.07	4.84	48,153.75	.26	27,706.52	.15
Health department.....	847,161.93	642,271.21	75.81	204,890.72	24.19						
Personal-injury claims.....	401.82	183.42	45.65	218.40	54.35						
Total health department.....	847,563.75	642,454.63	75.80	205,109.12	24.20						
Civil government.....	603,880.50	601,995.19	99.69	1,885.31	.39						
Personal-injury claims.....	388.83	388.83	100.00								
Total civil government.....	604,269.33	602,384.02	99.69	1,885.31	.39						
Total all departments.....	19,764,814.92	5,221,956.95	26.42	13,580,565.63	68.71	886,432.07	4.49	48,153.75	.24	27,706.52	.14

¹ Lock gate and machinery inspection.

² Joint land commission.

TABLE 13.—Statement of accounts receivable registered during the fiscal year ending June 30, 1914.

Month.	Number of bills registered.	Total.	Against the Panama R. R.	Against the Canal Zone government.	Against the Republic of Panama.	Against other departments of United States Government.	Against steamship companies.	Against other individuals and companies.	For pay-roll deductions.	For cash remitted by hotels, hospitals, etc.	Total.
1913—											
July.....	572	\$69,988.86	\$185,106.12	\$17,082.48	\$5,820.21	\$2,792.45	\$3,104.90	\$29,288.40	\$350,820.60	\$105,973.70	.....
August.....	519	723,443.45	270,795.03	6,607.37	5,722.11	5,324.85	3,773.87	35,454.99	37,493.11	37,272.12	.....
September.....	517	677,191.75	203,852.70	24,485.25	9,253.22	4,128.59	2,845.36	22,622.70	369,125.37	40,868.56	.....
October.....	467	767,711.23	202,202.44	5,436.24	9,440.57	7,550.13	19,302.78	84,830.74	347,765.04	91,183.29	.....
November.....	499	665,226.27	170,178.45	24,138.22	17,995.14	16,040.04	33,060.17	25,216.73	326,277.93	52,319.59	.....
December.....	511	618,197.49	191,368.04	7,493.54	17,939.03	5,225.38	11,095.56	61,894.87	283,467.54	40,113.53	.....
1914—											
January.....	479	610,261.29	107,638.67	4,152.48	4,856.81	32,107.24	14,505.55	38,378.90	318,212.29	90,379.35	.....
February.....	573	627,486.53	188,930.54	11,016.26	32,299.76	15,128.08	22,059.46	26,401.85	285,234.25	46,396.33	.....
March.....	391	840,294.24	202,170.26	11,134.96	32,841.30	19,225.03	26,961.58	7,263.72	490,730.78	49,966.61	.....
April.....	687	727,331.19	399,528.21	7,003.01	24,459.78	28,769.51	11,036.26	37,947.35	218,590.07	.....	.....
May.....	499	555,745.87	282,565.32	8,051.67	18,320.51	19,694.93	3,320.33	15,255.90	201,391.99	.....	\$7,146.12
June.....	564	641,349.15	286,376.38	31,143.11	18,778.56	11,216.96	6,837.39	81,684.82	197,839.37	.....	7,472.56
Total.....	6,238	8,154,630.32	2,690,742.16	157,744.59	197,727.00	167,203.19	157,903.21	466,240.07	3,747,978.34	554,473.08	14,618.68

TABLE 14.—*Panama Canal operation and maintenance, fiscal year ended June 30, 1914.*

Administration.....	\$16,839.75
Civil government.....	5,940.58
Health department.....	10,697.69
Maintenance:	
Maintenance of Gatun Dam.....	315.10
Maintenance of Gatun spillway.....	2,670.91
Gates and caisson.....	\$951.24
Operating machinery.....	1,719.67
Maintenance of Gatun locks.....	54,305.99
Gates.....	404.18
Emergency dams.....	2,496.60
Operating machinery and equipment.....	49,625.49
Towing track system.....	1,779.72
Maintenance of Pedro Miguel locks.....	22,634.55
Gates.....	407.92
Emergency dams.....	2,449.53
Operating machinery and equipment.....	19,444.89
Towing track system.....	217.35
Back fill.....	114.86
Maintenance of Miraflores spillway.....	856.05
Structure.....	151.78
Gates and caisson.....	143.52
Operating machinery.....	560.75
Maintenance of Miraflores locks.....	22,934.95
Gates.....	1,696.38
Emergency dams.....	1,824.31
Operating machinery and equipment.....	19,327.72
Towing track system.....	86.54
Clearing drift in lake.....	16,570.44
Total, maintenance.....	120,287.99
Operation:	
Admeasurement of vessels.....	740.71
Local inspection.....	752.10
Aids to navigation.....	812.12
Pilotage.....	263.42
Operation of locks.....	5,274.16
Total, operation.....	7,842.51
SUMMARY.	
Administration.....	16,839.75
Civil government.....	5,940.58
Health department.....	10,697.69
Maintenance.....	120,287.99
Operation.....	7,842.51
Total, operation and maintenance.....	161,608.52

TABLE 15.—Statement of hotel coupons and meal tickets honored during fiscal year ending June 30, 1914.

Month	Messes.						Hotels.		Cash col- lected.	Depart- ment and individual charges.	Total reve- nues.		
	9-cent tickets.		13½ cent tickets.		27-cent tickets.		40-cent tickets.					30-cent tickets.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.				Number.	Value.
1913—July.....	729	\$65.61	2,528	\$337.07	35,351	\$9,544.77	76,482	\$30,592.80	209,644	\$62,893.20	\$14,899.10	\$1,595.86	\$119,928.41
August.....	818	73.62	2,171	289.47	33,938	9,163.26	80,015	32,006.00	204,175	61,252.50	19,207.44	1,419.44	123,411.73
September.....	215	19.35	1,611	214.80	30,189	8,151.03	79,056	31,622.40	188,378	56,513.40	15,992.26	1,451.04	113,964.28
October.....	.....	.....	1,105	147.33	26,211	7,076.97	75,062	30,024.80	179,874	53,962.20	16,773.76	1,531.69	109,516.75
November.....	.....	.....	988	131.74	25,462	6,874.74	58,496	23,398.40	169,211	50,763.30	15,137.04	1,890.30	98,195.52
December.....	.....	.....	946	126.13	23,013	6,221.61	54,802	21,920.80	171,729	51,518.70	14,190.52	1,464.66	95,442.42
1914—January.....	.....	.....	1,048	139.73	23,955	6,467.85	50,661	20,264.40	169,628	50,888.40	15,693.62	1,804.72	95,258.72
February.....	7	.63	1,006	134.13	20,820	5,621.40	43,917	17,566.80	156,728	47,018.40	22,165.39	1,555.36	94,062.11
March.....	234	21.06	747	99.60	23,384	6,313.68	49,145	19,658.00	171,472	51,441.60	21,141.85	1,531.53	100,207.32
April.....	169	15.21	1,251	166.80	20,300	5,481.00	47,314	18,925.60	165,728	49,718.40	16,198.87	1,459.66	91,965.51
May.....	270	24.30	2,380	317.33	19,798	5,345.46	48,181	19,272.40	170,736	51,220.80	14,256.50	2,087.30	92,524.09
June.....	329	29.61	8	1.07	21,229	5,731.83	44,649	17,859.60	163,928	49,178.40	12,039.50	2,007.12	86,817.13
Total.....	2,771	249.39	15,789	2,105.20	303,680	81,993.60	707,780	283,112.00	2,121,231	636,369.30	197,695.85	19,798.68	1,221,324.02

TABLE 16.—Statement of commissary and hotel coupon books and meal tickets issued during fiscal year ending June 30, 1914.

Month.	Commissary coupon books.						Hotel coupon books.						Meal tickets.				Total values.
	\$2.50 books.			\$5 books.			\$4.80 books.			\$15 books.			27-cent tickets.		40-cent tickets.		
	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	
1913—July.....	14,845	\$37,112.50	34,811	\$174,055.00	4,702	\$71,430.00	390	\$1,872.00	2,545	\$38,175.00	36,800	\$9,936.00	60,200	\$24,080.00		\$356,660.50	
August.....	15,112	37,780.00	36,530	182,650.00	4,620	69,300.00	78	374.40	2,075	31,125.00	34,800	9,396.00	87,643	35,057.20		365,682.60	
September...	14,336	35,840.00	34,635	173,175.00	4,414	66,210.00	405	1,944.00	3,670	55,050.00	32,000	8,640.00	79,200	31,680.00		372,539.00	
October.....	18,076	45,190.00	30,122	150,610.00	4,159	62,385.00	250	1,200.00	6,755	101,325.00	24,700	6,669.00	64,900	25,960.00		393,339.00	
November.....	884	2,210.00	34,554	172,770.00	3,390	50,850.00	860	4,128.00	2,545	38,175.00	9,000	2,430.00	59,000	23,600.00		294,163.00	
December.....	226	565.00	39,168	195,840.00	4,516	67,740.00	100	480.00	1,570	23,550.00	22,300	6,021.00	41,000	16,400.00		310,596.00	
1914—January.....	371	927.50	35,398	176,990.00	3,488	52,320.00	50	240.00	5,830	87,450.00	14,200	3,834.00	38,200	15,280.00		337,041.50	
February.....	53	132.50	33,592	167,960.00	3,294	49,410.00	580	2,784.00	2,070	31,050.00	24,100	6,507.00	80,000	32,000.00		289,843.50	
March.....	21	52.50	35,721	178,605.00	3,080	46,200.00	25	120.00	800	12,000.00	15,100	4,077.00	33,800	13,520.00		254,574.50	
April.....	33	82.50	34,835	174,175.00	2,976	44,640.00	350	1,680.00	1,775	26,625.00	28,500	7,695.00	35,000	14,000.00		268,897.50	
May.....	29	72.50	31,146	155,730.00	3,062	45,930.00	605	2,904.00	5,610	84,150.00	23,300	6,291.00	45,400	18,160.00		313,237.50	
June.....	171	427.50	30,382	151,910.00	3,144	47,160.00	35	168.00	2,250	33,750.00	34,000	9,180.00	57,100	22,840.00		265,435.50	
Total.....	64,157	160,392.50	410,894	2,054,470.00	44,905	673,575.00	3,728	17,894.40	37,495	562,425.00	298,800	80,676.00	681,443	272,577.20		3,822,010.10	

NOTE.—The above figures represent the total of commissary coupon books issued to Panama Canal employees, collection for which has been made on pay rolls. Totals of hotel coupon books and meal tickets represent all the books and tickets distributed on the Isthmus for issue to the employees of The Panama Canal, Panama Railroad, and contractors.

TABLE 17.—*Revenues collected, Canal Zone funds, from July 1, 1913, to June 30, 1914.*

[This statement includes balances in hands of collecting officers, but does not include money-order, club-house, or trust funds.]

On account of—	Administrative districts.			
	Ancon.	Empire.	Cristobal.	Total.
Animal license.....	\$13.50	\$157.50	\$69.00	\$240.00
Aerated waters.....	246.80	2,000.80	1,163.20	3,410.80
Bicycle license.....	119.66	119.67	119.67	359.00
Building rental.....	2,010.60	2,042.25	.....	4,052.85
Burial permits.....	232.69	232.68	232.68	698.05
Cabs and coaches.....	.....	125.25	.....	125.25
Carts.....	76.00	730.50	250.50	1,057.00
Chauffeurs' licenses.....	48.33	48.34	48.33	145.00
Circuit court collections.....	2,694.61	2,712.36	2,350.42	7,757.39
Corporation tax.....	164.57	164.57	164.58	493.72
Dance halls.....	.....	.....	20.00	20.00
District court collections.....	3,668.15	5,526.25	3,486.53	12,680.93
Escheated estates.....	40.20	40.20	40.19	120.59
Gathering coconuts.....	.....	.....	118.00	118.00
Hucksters.....	14.00	.....	22.40	36.40
Hunting permits.....	219.67	219.67	219.66	659.00
Insurance tax.....	378.03	378.04	378.04	1,134.11
Interest.....	20,451.37	20,451.37	20,451.38	61,354.12
Land rental.....	1,401.25	2,055.80	.....	3,457.05
Magistrate court collections.....	1,740.35	968.15	1,122.20	3,830.70
Market rental.....	182.00	2,232.65	187.60	2,602.25
Marshal fees.....	146.37	526.91	359.98	1,033.26
Merchandise and drugs.....	176.60	2,510.30	1,213.10	3,900.00
Motor vehicle license.....	1,153.00	1,153.00	1,153.00	3,459.00
Navigator license.....	33.33	33.34	33.33	100.00
Peddling.....	1,431.00	2,957.50	1,837.50	6,226.00
Physicians' license.....	46.67	46.67	46.66	140.00
Police fines.....	78.67	78.66	78.67	236.00
Pound fees.....	110.50	82.00	30.34	222.84
Public entertainment.....	72.75	517.00	216.50	806.25
Real estate tax.....	1,664.80	.....	.....	1,664.80
Restaurants.....	44.80	171.60	71.80	288.20
Retail sale tobacco.....	176.40	2,110.00	1,070.00	3,356.40
Rewards.....	20.00	20.00	20.00	60.00
Sale imported meats.....	.....	9.12	70.20	79.32
Sale impounded animals.....	5.25	.....	14.50	19.75
Sale of property.....	3.32	3.32	3.31	9.95
School tuition, lost or damaged books.....	431.01	431.01	431.01	1,293.03
Service district prisoners.....	9.85	8.42	.66	18.93
Slaughter tax.....	79.50	5,231.00	387.00	5,697.50
Steamboat inspection.....	1,202.11	1,202.11	1,202.12	3,606.34
Water tax.....	1,766.20	15,651.66	14,089.00	31,506.86
Total.....	42,353.91	72,949.67	52,773.06	168,076.64
Stamp sales.....	.....	.....	.....	90,805.34
Stamp-book sales.....	.....	.....	.....	450.96
Money-order fees.....	.....	.....	.....	19,408.44
Exchange Martinique money-order business.....	.....	.....	.....	77.49
				278,818.87

TABLE 18.—*Expenditures, Canal Zone funds, July 1, 1913, to June 30, 1914.*

[This statement includes all outstanding audited claims, but does not include expenditures of money-order, clubhouse, or trust funds.]

On account of—	Administrative districts.			
	Ancon.	Empire.	Cristobal.	Total.
PUBLIC IMPROVEMENTS.				
Roads and trails:				
Construction.....	\$35,029.86	\$25,287.93	\$29,446.31	\$89,764.10
Maintenance.....	17,362.32	10,583.77	4,228.40	32,174.49
Market houses:				
Maintenance.....	14.86	56.00	79.38	150.24
Operation.....	496.88	670.80	526.53	1,694.21
Slaughter houses, operation.....	362.72	470.86	362.71	1,196.29
Waterworks and sewers:				
Construction.....			19.66	19.66
Maintenance.....	426.54	866.71	694.20	1,987.45
Sanitation native villages, maintenance.....	6,950.00	7,100.00	6,950.00	21,000.00
Streetlighting.....		308.60	48.00	356.60
Miscellaneous public works:				
Construction.....		30.22		30.22
Maintenance.....	139.05	540.84	178.24	858.13
PUBLIC SCHOOLS.				
Schoolhouses, maintenance.....	235.12	513.84	245.75	994.71
Salaries, superintendent, teachers, and clerks.....	22,707.07	22,707.15	22,722.10	68,136.32
Janitor service.....	659.53	1,136.71	858.06	2,654.30
Furniture and equipment.....	158.92	136.83	146.17	441.92
Supplies.....	1,227.60	1,236.74	1,236.22	3,700.56
Traveling and miscellaneous expenses.....	3,616.38	3,347.08	3,587.07	10,550.53
MAINTENANCE OF ADMINISTRATIVE DISTRICTS.				
Salaries, district judges.....	3,683.44	3,683.44	3,683.45	11,050.33
Salaries, magistrates.....	717.76	717.79	717.79	2,153.34
Supplies and miscellaneous.....	240.93	267.52	376.00	884.45
Zone charity cases, maintenance.....	791.73	782.74	833.73	2,408.20
District prisoners, maintenance.....	2,510.82	3,223.06	1,566.19	7,300.07
	97,331.53	83,668.63	78,476.64	259,476.80
CONTINGENT EXPENSES.				
Gratuity penitentiary prisoners.....				930.00
Miscellaneous expenses.....				657.37
POSTAL SERVICE.				
Purchase of stamps.....				36,403.29
Transportation of mails:				
Isthmus.....				3,530.00
Ocean.....				24,133.09
Miscellaneous expenses.....				10,810.08
Transfer to Panama Canal as reimbursement in part for salaries paid.....				20,000.00
Total.....				355,940.63

¹ Credits.

TABLE 19.—*Statement of balances with collector, by appropriations, June 30, 1914.*

Public improvements and schools.....	\$134,343.85
Miscellaneous and contingent.....	5,713.78
Postal receipts, 1914.....	24,339.50
Money-order funds.....	958,696.80
Clubhouse funds.....	26,513.96
Trust funds.....	13,176.23
Postal savings funds.....	489,818.00
Total.....	1,652,602.12

TABLE 20.—*Statement of receipts and disbursements, Canal Zone funds, May 1, 1904, to June 30, 1914.*

RECEIPTS.		
Revenues collected.....	\$1, 833, 147. 77	
Postal receipts.....	851, 920. 47	
Total collections.....		\$2, 685, 068. 24
DISBURSEMENTS.		
Expenditures:		
Public improvements.....	\$864, 417. 39	
Public schools.....	648, 514. 83	
Maintenance administrative districts.....	208, 070. 78	
Miscellaneous and contingent.....	21, 309. 58	
Postal service.....	780, 220. 35	
Total disbursements.....		2, 522, 532. 93
Available for expenditure.....		162, 535. 31
COLLECTOR'S BALANCE, JUNE 30, 1914.		
Public improvements and schools.....	\$134, 343. 85	
Miscellaneous and contingent.....	5, 713. 78	
Postal receipts, 1914.....	24, 339. 50	
	164, 397. 13	
Collecting officers' balance.....	583. 65	
Postmasters' balance.....	2, 778. 83	
	167, 759. 61	
Transfer water deposit.....	\$18. 80	
Transfer money-order fees.....	2, 821. 80	
	2, 840. 60	
	170, 600. 21	
Unpaid audited claims.....	8, 064. 90	
Balance available.....		162, 535. 31
SEPARATE STATEMENT COVERING POSTAL SERVICE.		
Receipts:		
Stamp sales.....	\$687, 652. 38	
Stamp-book sales.....	1, 117. 03	
Sale of mail matter.....	52. 20	
Money-order fees.....	163, 002. 18	
Exchange Martinique money-order business.....	96. 68	
		851, 920. 47
Disbursements:		
Balance of funds prior to Mar. 4, 1907, consolidated with regular Zone revenues.....	42, 453. 93	
Purchase of stamps.....	277, 333. 42	
Miscellaneous expenditures.....	264, 373. 72	
Transfer to Panama Canal as reimbursement in part for salaries paid.....	238, 513. 21	
		822, 674. 28
Available for expenditure.....		29, 246. 19
Collector's balance.....	24, 339. 50	
Postmasters' balance.....	2, 778. 83	
Transfer money-order fees.....	2, 821. 80	
	29, 940. 13	
Unpaid audited claims.....	693. 94	
		29, 246. 19

TABLE 21.—Receipts, Canal Zone funds, from May 1, 1904, to June 30, 1914.

[This statement includes balances in hands of collecting officers, but does not include money-order, clubhouse, or trust funds.]

On account of—	May 1, 1904, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	July 1, 1912, to June 30, 1913.	July 1, 1913, to June 30, 1914.	Total.
REVENUES.										
Animal licenses.....				\$1,013.40	\$492.60	\$585.70	\$462.00	\$453.30	\$240.00	\$3,652.75
Aerated water.....		\$3.25	\$402.50	6,960.80	7,203.20	6,208.80	5,859.60	5,377.20	3,410.80	35,020.40
Auctioneers.....				43.00	35.00	27.00	29.00			134.00
Bicycle licenses.....							645.00	487.00	359.00	1,491.00
Building rental.....			4,592.00	7,026.25	4,995.35	4,481.26	7,742.28	7,701.25	4,052.85	40,591.24
Bowling alleys.....				84.00	65.00	15.00				164.00
Burial permits.....	\$315.00	\$15.80	1,063.00	921.00	1,259.00	1,812.50	1,950.00	1,859.65	698.05	10,694.00
Burning charcoal.....				29.08						29.08
Cabs and coaches.....		124.75	861.20	42.25	33.25	85.25	174.00	202.00	125.25	1,617.95
Carts.....				290.20	380.00	2,188.80	4,160.50	2,310.50	1,057.00	10,387.00
Corporation tax.....								100.00	493.72	593.72
Cutting firewood.....				6.50						6.50
Circuit court collections.....	3,821.31	3,196.82	6,793.53	8,510.10	7,511.45	7,001.40	8,490.98	9,637.02	7,757.39	62,720.00
Chaufeurs' licenses.....							97.00	122.00	145.00	364.00
District court collections.....		6,875.40	30,390.52	25,448.75	30,299.69	22,449.19	28,169.79	26,223.27	12,680.93	182,537.54
Dance hall.....	12,520.33	5,174.95	3,814.94	320.00	290.00	160.00	160.00	60.00	20.00	1,010.00
Distilling licenses.....				2,209.00	3,138.67	2,544.98	5,083.71	9,130.55		43,637.13
Escheated estates.....					680.04	1,558.27		7.50	120.59	2,366.40
Gathering coconuts.....				111.75	105.00	108.75	599.70	140.75	118.00	1,183.95
Hucksters.....				84.60	114.80	90.80	93.20	49.60	36.40	1,469.40
Hunting permits.....	165.00	810.00	1,570.00	1,681.00	1,739.00	1,965.00	1,715.00	1,635.00	639.00	11,939.00
Hotels.....				28.40					28.40	
Insurance tax.....			129.02	137.70	234.34	512.59	1,087.83	1,180.38	1,134.11	4,415.97
Interest.....					36,867.94	27,763.40	20,784.96	32,647.77	61,354.12	179,418.19
Land rental.....		584.05	18,803.82	20,448.07	22,282.69	19,120.80	8,569.80	3,731.95	3,457.05	96,998.23
Magistrate court collections.....									3,830.70	3,830.70
Public works refund.....										1,491.00
Market rental.....	63.25	1,044.13	5,734.24	4,381.88	1,491.00	5,039.58	4,199.90	3,829.10	2,602.25	31,287.63
Miscellaneous.....		512.55	623.93	43.00	4,456.55					1,302.73
Motor vehicle licenses.....						1,058.00	2,039.00	1,628.87	3,459.00	8,204.87
Merchandise and drugs.....		4,656.71	34,913.58	10,409.01	9,722.26	10,095.20	8,090.68	6,646.31	3,900.00	88,433.75
Marshal fees.....			61.27	364.91	658.02	1,697.94	2,099.45	150.00	1,033.26	7,548.63
Navigators' licenses.....				10,032.50	10,084.00	8,885.00	8,167.50	8,229.00	6,226.00	51,624.00
Peddling.....		21.00	80.00	80.00	130.00	95.00	135.00	95.00	140.00	841.00
Physicians' licenses.....	65.00									
Pipe-line licenses.....		5,500.00	6,000.00	4,500.00						16,000.00
Public entertainment.....		225.52	1,225.50	820.80						6,393.27
Poll tax.....		834.00	3,170.00	2,801.00	814.90	519.10	677.90	1,303.30	806.25	11,021.00
Pound fees.....			140.30	589.23	1,734.80	1,169.60	1,008.40	302.40		2,880.91
					536.10	531.40	530.47	330.57	222.84	

TABLE 21.—Receipts, Canal Zone funds, from May 1, 1904, to June 30, 1914—Continued.

On account of—	May 1, 1904, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	July 1, 1912, to June 30, 1913.	July 1, 1913, to June 30, 1914.	Total.
REVENUES—continued.										
Police fines.....	\$786.05	\$444.67	\$540.99	\$789.04	\$424.00	\$332.92	\$453.83	\$144.00	\$236.00	\$4,151.50
Restaurants.....	.....	257.70	1,395.70	1,274.20	1,515.20	1,181.20	1,076.00	1,227.00	288.20	8,215.20
Retail liquor licenses.....	2,513.92	.....	40,800.00	72,600.00	65,040.00	97,200.00	48,089.88	21,400.00	.....	347,643.80
Retail sale of tobacco.....	.....	.....	.....	8,621.60	9,084.00	8,474.00	7,657.20	6,543.20	3,356.40	43,736.40
Real estate tax.....	.....	3,932.18	11,991.16	29,791.25	32,710.96	41,133.61	32,078.11	7,215.40	1,664.80	160,517.47
Sale of property.....	.....	.....	72.50	3,572.50	282.10	5,512.40	1,154.47	531.40	9.95	11,135.32
Sale of imported animals.....	.....	.....	.....	35.10	13.25	24.40	191.85	17.00	19.75	301.35
Sale of imported meats.....	.....	.....	.....	437.82	545.21	315.91	62.56	216.39	79.32	1,657.21
School tuition, lost or damaged books.....	.....	30.42	247.10	577.59	293.08	774.28	876.23	872.22	1,293.03	4,963.95
Stamp paper.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	316.31
Services district prisoners.....	.....	149.80	.....	.....	867.85	6.40	31.86	47.76	18.93	1,122.60
Sluggish tax.....	1,547.46	4,697.55	13,449.00	12,894.00	15,496.00	17,634.50	12,395.00	9,815.00	5,697.50	93,626.01
Steamboat inspection.....	.....	.....	.....	.....	.....	.....	2,837.15	2,738.55	3,606.34	9,182.04
Water tax.....	.....	470.95	2,994.37	7,535.80	12,962.45	20,531.70	30,012.89	34,293.89	31,506.86	140,308.91
Total revenues.....	22,113.63	40,362.20	191,860.17	247,547.88	286,608.75	320,891.63	259,759.68	212,286.83	168,076.64	1,749,487.41
Municipal funds transferred.....	.....	.....	83,660.36	.....	.....	.....	.....	.....	.....	83,660.36
POSTAL RECEIPTS.										
Postage stamps.....	39,913.67	55,542.24	72,709.54	74,327.40	83,847.10	82,613.72	87,441.58	100,451.79	90,805.34	687,652.38
Stamp books.....	.....	.....	.....	.....	.....	.....	199.87	466.20	450.96	1,117.03
Sale of mail matter.....	.....	.....	.....	.....	.....	.....	.....	52.20	.....	52.20
Money-order fees.....	197.25	9,732.25	19,309.14	21,720.93	22,957.29	32,457.98	22,871.68	23,347.12	19,408.44	163,002.18
Exchange Martinique, M. O. B.....	.....	.....	.....	.....	.....	.....	.....	19.19	77.49	96.68
Total postal receipts.....	40,110.92	65,274.59	92,018.68	96,048.33	106,804.39	106,071.70	110,513.13	124,336.50	110,742.23	881,920.47
SUMMARY OF RECEIPTS.										
Revenues.....	22,113.63	40,362.20	191,860.17	247,547.88	286,608.75	320,891.63	259,759.68	212,286.83	168,076.64	1,749,487.41
Municipal funds.....	.....	.....	83,660.36	.....	.....	.....	.....	.....	.....	83,660.36
Postal receipts.....	40,110.92	65,274.59	92,018.68	96,048.33	106,804.39	106,071.70	110,513.13	124,336.50	110,742.23	881,920.47
Total receipts.....	62,224.55	105,636.79	367,539.21	343,596.21	393,413.14	426,963.33	370,272.81	336,603.33	278,818.87	2,685,068.24

TABLE 22.—*Expenditures from July 1, 1905, to June 30, 1914.*

(This statement includes all outstanding audited claims, but does not include expenditures of money-order, clubhouse, or trust funds.)

On account of—	July 1, 1905, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	July 1, 1912, to June 30, 1913.	July 1, 1913, to June 30, 1914.	Total.
PUBLIC IMPROVEMENTS.										
Roads and trails:										
Construction.....										\$472,079.36
Maintenance.....										128,308.29
Market houses:										
Construction.....										19,576.90
Maintenance.....										9,979.92
Operation.....										12,277.31
Slaughter houses:										
Construction.....										1,084.19
Maintenance.....										2,538.16
Operation.....										8,540.83
Water works and sewers:										
Construction.....										51,612.59
Maintenance.....										12,099.71
Sanitation native villages.....										74,924.15
Street lighting.....										8,520.19
Miscellaneous public works:										
Construction.....										8,803.13
Maintenance.....										54,012.66
Total improvements.....										864,417.39
PUBLIC SCHOOLS.										
School houses:										
Construction.....										98,095.97
Maintenance.....										24,132.00
Rental.....										1,701.66
Salaries, superintendent, teachers, and clerks.....										417,343.84
Janitor service.....										18,117.25
Furniture and equipment.....										17,330.36
Supplies.....										32,645.76
Traveling and miscellaneous.....										39,147.99
Total public schools.....										648,514.83

¹ Credit.

TABLE 22.—Expenditures from July 1, 1905, to June 30, 1914—Continued.

On account of—	July 1, 1905, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	July 1, 1912, to June 30, 1913.	July 1, 1913, to June 30, 1914.	Total.
MAINTENANCE, ADMINISTRATIVE DISTRICTS.										
Tax collectors salaries.....				\$11, 117. 00	\$11, 730. 82	\$4, 038. 32	\$15, 676. 65	\$13, 768. 35	\$11, 050. 33	\$26, 886. 14
District judges.....				12, 930. 00	16, 726. 66	17, 538. 16			2, 153. 34	\$7, 750. 15
Magistrates.....				1, 826. 41	3, 452. 29	1, 027. 90	1, 011. 63	1, 877. 80	884. 45	2, 153. 34
Supplies and miscellaneous.....				409. 42	5. 10		39. 01			10, 080. 48
Equipment.....				3, 383. 90	800. 00	3, 600. 00	2, 400. 00	3, 244. 80	2, 408. 20	453. 53
Zone charity cases, maintenance.....				8, 154. 19	15, 485. 00	11, 591. 32	12, 503. 21	9, 829. 05	7, 300. 07	15, 836. 90
District prisoners, maintenance.....		\$13. 40	\$4. 00							64, 910. 24
Total maintenance, administrative districts.....		43. 40	4. 00	37, 880. 92	48, 199. 87	37, 795. 70	31, 630. 50	28, 720. 00	23, 796. 39	208, 070. 78
CONTINGENT EXPENSES.										
Gratuity discharged penitentiary prisoners.....			165. 00	645. 00	757. 50	667. 50	892. 50	750. 00	930. 00	4, 807. 50
Election expenses.....	\$172. 97		997. 69	9, 679. 49	1, 200. 70	385. 15	299. 62	586. 37	657. 37	9, 679. 49
Miscellaneous.....				804. 59						6, 822. 59
Total contingent expenses.....	172. 97	1, 718. 13	1, 162. 69	11, 129. 08	1, 958. 20	1, 052. 65	1, 192. 12	1, 336. 37	1, 587. 37	21, 309. 58
POSTAL SERVICE.										
Purchase of stamps.....	9, 993. 89	37, 766. 11	31, 160. 00	38, 460. 00	29, 400. 00	28, 075. 60	31, 711. 42	34, 363. 11	36, 403. 29	277, 333. 42
Transportation of mails:										
Isthmus.....				13, 851. 17	14, 950. 67	12, 760. 00	15, 175. 00	13, 990. 00	3, 530. 00	74, 256. 84
Ocean.....				13, 938. 00	17, 419. 28	10, 782. 56	40, 722. 19	27, 859. 11	24, 133. 09	134, 874. 23
Supplies and miscellaneous.....				5, 486. 67	10, 417. 19	7, 508. 03	10, 663. 00	10, 357. 68	10, 810. 08	55, 242. 65
Transfer to Isthmian Canal Commission as reimbursement in part for salaries paid.....			68, 513. 21	20, 000. 00	35, 000. 00	40, 000. 00		55, 000. 00	20, 000. 00	238, 513. 21
Total postal service.....	9, 993. 89	37, 766. 11	99, 673. 21	91, 755. 84	107, 187. 14	99, 126. 19	98, 271. 61	141, 569. 90	94, 576. 46	780, 220. 35
SUMMARY OF DISBURSEMENTS.										
Public improvements.....		8, 690. 03	43, 538. 51	151, 874. 19	260, 771. 65	59, 068. 15	80, 368. 29	110, 904. 50	149, 202. 07	864, 417. 39
Public schools.....		49, 063. 97	38, 811. 33	120, 012. 83	77, 843. 40	82, 970. 46	100, 997. 23	92, 357. 27	86, 478. 34	648, 514. 83
Maintenance, administrative districts.....		43. 40	4. 00	37, 880. 92	48, 199. 87	37, 795. 70	31, 630. 50	28, 720. 00	23, 796. 39	208, 070. 78
Contingent expenses.....	172. 97	1, 718. 13	1, 162. 69	11, 129. 08	1, 958. 20	1, 052. 65	1, 192. 12	1, 336. 37	1, 587. 37	21, 309. 58
Postal service.....	9, 993. 89	37, 766. 11	99, 673. 21	91, 755. 84	107, 187. 14	99, 126. 19	98, 271. 61	141, 569. 90	94, 576. 46	780, 220. 35
Total disbursements.....	10, 166. 86	97, 281. 64	183, 189. 74	412, 652. 86	495, 960. 26	280, 013. 15	312, 459. 75	374, 868. 04	355, 940. 63	2, 522, 532. 93

POSTAL SERVICE.

TABLE 23.—Statement showing total value of money orders issued, money orders paid, money orders outstanding, and balance of money-order funds June 30, 1914.

Year ending June 30—	Money orders issued.	Money orders paid by—				
		United States.	Canal Zone.	Martinique.	Costa Rica.	Total.
1907.....	\$2,369,031.49	\$1,581,251.91	\$208,165.48	.....	.....	\$1,789,417.39
1908.....	4,686,684.98	2,875,719.61	1,017,750.97	.....	.....	3,893,470.58
1909.....	5,166,749.46	3,583,419.57	1,492,144.76	.....	.....	5,075,564.33
1910.....	5,228,553.60	4,068,650.16	1,331,568.20	\$2,267.60	.....	5,402,485.96
1911.....	5,304,906.60	3,725,996.12	1,337,915.09	6,022.08	.....	5,069,933.29
1912.....	4,915,077.26	3,521,511.95	1,280,397.88	8,176.95	\$1,062.40	4,811,149.18
1913.....	4,883,624.13	4,286,948.31	881,728.73	9,646.65	3,046.10	5,181,369.79
1914.....	4,029,364.97	4,070,694.55	776,265.68	11,684.18	4,634.53	4,863,278.94
Total.....	36,583,992.49	27,714,192.18	8,325,936.79	37,797.46	8,743.03	36,086,669.46

SUMMARY.

Total money orders issued.....	\$36,583,992.49
Total money orders paid.....	33,086,669.46

Total outstanding.....	497,323.03
------------------------	------------

MONEY ORDER FUNDS.

Cash in hand, collector, Panama Canal.....	955,875.00
Cash in hand, postmasters.....	15,792.45
Due from Costa Rica postal department.....	105.72
	\$971,737.17
Due Martinique postal department.....	3,027.41
Due United States Postal Department.....	471,422.73
Unpaid money orders outstanding.....	497,323.03
	971,773.17

TABLE 24.—Statement showing the monthly money-order business of the Canal Zone postal service for the fiscal year ended June 30, 1914.

Month.	Amount issued.	Fees.	Money orders paid in Canal Zone post offices.			
			United States.	Martini- que.	Costa Rica.	Canal Zone.
1913—July.....	\$400,092.72	\$1,906.90	\$7,686.90	\$38.84	\$10.00	\$80,102.32
August.....	402,931.50	1,890.18	8,699.96	46.59	15.00	78,131.42
September.....	406,484.88	1,868.85	7,236.11	57.21	25.00	77,532.35
October.....	340,910.46	1,643.01	7,249.57	19.42	.50	64,567.37
November.....	360,567.01	1,749.03	5,747.06	25.24	70.00	66,389.34
December.....	350,527.12	1,768.04	6,332.09	.....	69.16	76,136.68
1914—January.....	310,194.87	1,520.56	8,290.51	.....	.....	58,102.70
February.....	282,886.96	1,383.33	6,568.05	23.30	50.00	48,571.67
March.....	296,510.00	1,449.10	7,706.73	.....	30.00	59,933.25
April.....	295,163.21	1,411.91	7,701.97	24.27	10.00	61,823.22
May.....	293,501.56	1,407.64	7,125.47	14.56	45.72	57,771.99
June.....	289,594.68	1,409.89	8,180.01	19.42	50.00	47,203.37
Total.....	4,029,364.97	19,408.44	88,533.43	268.85	375.38	776,265.68

Month.	Canal Zone orders paid in—			Cash remittance to United States Post Office Department.
	Martinique.	Costa Rica.	United States.	
1913—July.....	.....	\$1,959.80	¹ \$676,732.63	\$305,000.00
August.....	.....	.....	352,695.73	285,000.00
September.....	.....	.....	324,456.33	275,000.00
October.....	.....	1,115.85	242,781.06	280,000.00
November.....	\$3,931.97	.....	390,480.04	265,000.00
December.....	.....	.....	267,277.76	320,000.00
1914—January.....	2,391.50	862.90	346,074.53	280,000.00
February.....	.....	.....	250,558.99	260,000.00
March.....	2,251.75	.....	253,580.12	252,000.00
April.....	.....	695.98	216,381.34	280,000.00
May.....	.....	.....	594,130.28	287,000.00
June.....	3,108.96	.....	155,545.74	312,000.00
Total.....	11,684.18	4,634.53	4,070,694.55	3,401,000.00

¹ Includes June, 1913.

Orders issued, 198,009. Average value of orders, \$20.35.

TABLE 25.—*Statement of money-order business and stamp sales, fiscal year ended June 30, 1914.*

Post offices.	Amount issued.	Money orders paid at Canal Zone post offices.				Postal receipts.	
		United States.	Canal Zone.	Martini-que.	Costa Rica.	Money-order fees.	Stamp sales.
Ancon.....	\$744,445.50	\$20,884.01	\$106,465.25	\$100.90	\$253.38	\$3,702.77	{ \$20,560.00 1 441.85
Balboa.....	421,243.35	5,486.54	66,600.80	.....	20.00	1,964.76	7,036.40
Bas Obispo.....	37,430.97	1,550.17	9,795.74	.....	.....	186.81	1,024.29
Corozal.....	400,349.42	6,471.89	95,274.08	14.56	.....	1,768.21	5,685.20
Cristobal.....	827,118.29	21,666.39	166,469.64	38.84	52.00	3,894.13	{ 22,175.00 1 21.82
Culebra.....	241,129.06	6,304.97	39,121.94	44.66	25.00	1,250.68	5,721.00
Empire.....	422,235.73	8,133.78	54,598.38	23.30	.....	2,056.11	8,745.30
Gatun.....	321,051.82	6,549.79	90,274.43	.....	5.00	1,658.75	7,762.00
Gorgona.....	22,299.78	506.49	6,965.40	.....	.....	93.83	309.06
Las Cascadas.....	89,350.57	6,273.62	8,893.42	.....	15.00	477.06	3,384.00
Matachin.....	2,892.25	12.64	1,041.66	.....	.....	15.19	105.16
Miraflores.....	21,288.28	70.69	14,360.55	.....	.....	103.82	457.08
Paraiso.....	207,513.37	2,151.77	43,041.61	.....	.....	997.04	3,735.00
Pedro Miguel.....	190,322.11	1,702.06	53,274.48	.....	5.00	886.20	2,585.74
Station A.....	51,116.91	526.87	14,693.48	.....	.....	216.41	569.95
Station B.....	29,577.56	241.75	4,845.26	46.59	.....	136.67	540.71
District quartermaster, Mount Hope.....	.....	.....	.....	.....	.....	.....	184.00
Frijoles.....	.....	.....	.....	.....	.....	.....	16.82
Gamboa.....	.....	.....	.....	.....	.....	.....	72.00
Monte Lirio.....	.....	.....	.....	.....	.....	.....	123.92
Invalidated money orders paid by warrant.....	.....	.....	549.56	.....	.....	.....	.....
Total.....	4,029,364.97	88,533.43	776,265.68	268.85	375.38	19,408.44	91,256.30

¹ Newspaper postage.TABLE 26.—*Statement of money-order fees, postal savings transactions, and stamp sales, fiscal year ended June 30, 1914.*

Post offices.	Postal receipts.		Postal savings bank transactions.			
	Money-order fees.	Stamp sales.	Balance on hand July 1, 1913.	Deposits	Withdrawals.	Balance.
Ancon.....	\$3,702.77	{ \$20,560.00 1 441.85	\$44,211.00	\$185,556.00	\$181,067.00	\$48,700.00
Balboa.....	1,964.76	7,036.40	45,793.00	235,781.00	247,914.00	33,660.00
Bas Obispo.....	186.81	1,024.29	9,818.00	15,081.00	16,484.00	8,415.00
Corozal.....	1,768.21	5,685.20	74,889.00	349,250.00	370,726.00	53,413.00
Cristobal.....	3,894.13	{ 22,175.00 1 21.82	36,762.00	156,332.00	147,128.00	45,966.00
Culebra.....	1,250.68	5,721.00	47,633.00	101,185.00	112,612.00	36,206.00
Empire.....	2,056.11	8,745.30	45,152.00	176,637.00	197,597.00	24,192.00
Gatun.....	1,658.75	7,762.00	61,560.00	154,093.00	163,741.00	51,912.00
Gorgona.....	93.83	309.06	72,539.00	5,320.00	22,739.00	55,120.00
Las Cascadas.....	477.06	3,384.00	45,604.00	62,400.00	76,037.00	31,976.00
Matachin.....	15.19	105.16	7,091.00	201.00	7,178.00	114.00
Miraflores.....	103.82	457.08	34,978.00	7,750.00	36,581.00	6,147.00
Paraiso.....	997.04	3,735.00	39,260.00	124,459.00	128,071.00	35,648.00
Pedro Miguel.....	886.20	2,585.74	70,749.00	104,890.00	118,275.00	57,364.00
Station A.....	216.41	569.95	2,771.00	13,051.00	12,823.00	2,999.00
Station B.....	136.67	540.71	6,880.00	16,535.00	16,766.00	6,649.00
District quartermaster, Mount Hope.....	.....	184.00	.....	.....	.....	.....
Frijoles.....	.....	16.82	.....	.....	.....	.....
Gamboa.....	.....	72.00	.....	.....	.....	.....
Monte Lirio.....	.....	123.92	.....	.....	.....	.....
Total.....	19,408.44	91,256.30	645,690.00	1,708,530.00	1,855,739.00	498,481.00

¹ Second-class postage.

Bas Obispo post office discontinued Jan. 31, 1914; Gorgona post office discontinued Aug. 15, 1913; Matachin post office discontinued July 31, 1913; Miraflores post office discontinued Sept. 15, 1913; Station A discontinued Apr. 30, 1914; Station B discontinued May 29, 1914.

TABLE 27.—*Statement of clubhouse receipts and disbursements.*

	Cash on hand July 1, 1913.	Balance of de- posit with treasurer July 1, 1913.	Receipts July 1, 1913, to June 30, 1914.	Total.	Disburse- ments July 1, 1913, to June 30, 1914.	Cash on hand June 30, 1914.	Balance deposit with collector June 30, 1914.	Total balance available June 30, 1914.
Balboa.....			\$5,459.04	\$5,459.04	\$4,744.84	\$281.99	\$1,768.59	\$2,050.58
Corozal.....	\$23.08	\$2,739.07	28,501.61	31,263.76	28,019.50	341.23	2,903.03	3,244.26
Cristobal.....	240.04	2,717.91	25,984.53	28,942.48	24,099.18	282.60	4,560.70	4,843.30
Culebra.....	147.95	1,775.26	9,494.68	11,417.89	9,250.09	267.46	1,900.34	2,167.80
Empire.....	410.78	6,575.04	28,290.67	35,276.49	29,495.52	367.67	5,413.30	5,780.97
Gatun.....	323.43	6,010.34	23,149.42	29,483.19	23,592.68	340.77	5,549.74	5,890.51
Gorgona.....	307.03	4,939.74	1,330.97	6,577.74	2,514.78		² 1,386.37	1,386.37
Pedro Miguel.....			4,830.03	4,830.03	5,013.14	235.40	³ 921.70	1,157.10
Porto Bello.....	82.91	1,057.20	5,583.10	6,723.21	6,357.22		365.99	365.99
Unpaid audited vouchers June 30, 1914.....	1,535.22	25,814.56	132,624.05	159,973.83	133,086.95	2,117.12	24,769.76	26,886.88
Collector's bal- ance as shown on account cur- rent June 30, 1914.....							1,744.20	
							26,513.96	

¹\$1,336.38 transferred from Gorgona Clubhouse.²\$1,340.21 transferred from Gorgona Clubhouse.³\$2,676.59 transferred to Balboa and Pedro Miguel.TABLE 28.—*Clubhouses' receipts, July 1, 1913, to June 30, 1914.*

	Balboa.	Corozal.	Cristobal.	Culebra.	Empire.
Membership.....	\$577.00	\$3,231.50	\$3,361.75	\$1,527.00	\$2,722.50
Soda fountain.....	1,942.98	9,507.12	8,480.09	2,407.32	10,534.20
Billiards and pool.....	535.65	938.85	1,094.80	587.07	1,637.85
Barber shop.....		1,720.65	1,070.00	581.30	1,470.92
Bowling alley.....		678.30	884.60	735.10	810.15
Salable merchandise.....		695.98	763.35	233.19	375.92
Entertainments:					
States.....	344.70	677.60	616.18	470.79	790.49
Local.....	69.50	763.30	1,385.91	482.40	1,062.46
Library deposits and fines.....	42.00	155.45	155.29	69.00	119.85
Instructions.....	37.50		470.55	40.00	309.25
Panama R. R. suspense.....	50.00	300.00	300.00	200.00	300.00
Pressing club.....	120.75	774.00	118.00	22.50	713.50
Tournaments.....	13.00	238.96	485.80	205.37	246.58
Cigars and candy.....	1,621.31	8,211.80	6,408.41	1,599.34	6,567.70
Motion pictures.....	104.65	608.10	389.80	332.80	629.30
Maintenance and general expense.....				1.50	
Total.....	5,459.04	28,501.61	25,984.53	9,494.68	28,290.67

	Gatun.	Gorgona	Pedro Miguel.	Porto Bello.	Total.
Membership.....	\$2,863.50	\$240.07	\$1,005.00	\$428.00	\$15,956.32
Soda fountain.....	7,710.19	484.40	1,499.10	2,799.62	45,365.02
Billiards and pool.....	1,133.45	40.15	215.97	314.15	6,497.94
Barber shop.....	1,495.29	73.50	89.45	88.95	6,590.06
Bowling alley.....	1,156.10	17.70	205.95		4,487.90
Salable merchandise.....	623.80	47.25	108.25	79.15	2,926.89
Entertainments:					
States.....	539.41		271.75	44.19	3,755.11
Local.....	904.90	49.85	90.30	140.25	4,948.87
Library deposits and fines.....	144.69	1.50	69.35	16.50	773.63
Instructions.....	141.00				998.30
Panama R. R. suspense.....	331.50	30.00	40.00	200.00	1,751.50
Pressing club.....	407.50	31.50	66.50	3.00	2,257.25
Tournaments.....	521.33	4.80	22.75	26.76	1,765.35
Cigars and candy.....	4,596.86	310.25	711.11	1,371.38	31,398.16
Motion pictures.....	565.90		434.55	71.15	3,136.25
Maintenance and general expense.....	14.00				15.50
Total.....	23,149.42	1,330.97	4,830.03	5,583.10	132,624.05

TABLE 29.—*Clubhouses' disbursements, July 1, 1913, to June 30, 1914.*

	Balboa.	Corozal.	Cristobal.	Culebra.	Empire.
Billiards and pool:					
Salaries.....	\$57. 50	\$456. 90	\$555. 73	\$382. 27	\$565. 67
Supplies and equipment.....	142. 05	180. 81	154. 57	153. 17	216. 04
Bowling alleys:					
Salaries.....		731. 58	1, 002. 72	669. 09	921. 95
Supplies and equipment.....	2. 60	253. 18	93. 55	144. 01	231. 60
Entertainment:					
Local.....	129. 58	1, 717. 60	1, 980. 99	1, 325. 00	2, 610. 21
States.....	350. 04	993. 09	1, 084. 92	762. 45	1, 800. 63
Office help.....	268. 34	1, 647. 11	1, 114. 06	388. 88	1, 599. 70
Library books and periodicals.....	186. 79	312. 98	199. 46	149. 46	146. 42
Maintenance and general expense.....	123. 51	332. 43	325. 10	141. 79	398. 54
Gymnasium supplies and equipment.....		62. 33	57. 06	21. 06	46. 52
Salable merchandise.....		712. 24	526. 55	143. 80	207. 04
General equipment, supplies, and expenses.....	423. 36	737. 07	611. 44	206. 13	951. 38
Soda fountain.....	1, 370. 99	8, 294. 77	7, 071. 32	1, 892. 38	8, 856. 03
Barber shop.....		1, 714. 53	1, 129. 21	590. 69	1, 586. 26
Pressing club.....	72. 37	692. 13	93. 60		713. 31
Instructions.....	5. 00		439. 05	40. 00	327. 25
Refunds.....	12. 00	172. 50	127. 75	63. 00	203. 50
Tournaments.....	3. 00	237. 90	566. 34	260. 63	427. 19
Cigars and candies.....	1, 330. 46	8, 264. 57	6, 396. 34	1, 569. 83	6, 767. 05
Motion pictures.....	267. 25	505. 78	569. 42	346. 45	919. 23
Total.....	4, 744. 84	28, 019. 50	24, 099. 18	9, 250. 09	29, 495. 52

	Gatun.	Gorgona.	Pedro Miguel.	Porto Bello.	Total.
Billiards and pool:					
Salaries.....	\$496. 96	\$12. 50	\$139. 38	\$97. 71	\$2, 764. 62
Supplies and equipment.....	48. 95	1. 37	99. 42	30. 51	1, 026. 89
Bowling alleys:					
Salaries.....	1, 017. 11	50. 91	212. 26		4, 605. 62
Supplies and equipment.....	195. 20	70. 63	111. 85		1, 102. 62
Entertainment:					
Local.....	2, 271. 39	512. 04	482. 00	381. 16	11, 409. 97
States.....	1, 754. 19	111. 45	169. 18	153. 00	7, 178. 95
Office help.....	1, 339. 06	117. 33	444. 35	489. 06	7, 407. 89
Library books and periodicals.....	421. 49		304. 63	275. 29	1, 996. 52
Maintenance and general expense.....	228. 90	45. 50	125. 03	141. 49	1, 862. 29
Gymnasium supplies and equipment.....	119. 85	9. 51	1. 20		317. 53
Salable merchandise.....	423. 50	8. 10	221. 74	77. 85	2, 520. 82
General equipment, supplies, and expenses.....	639. 43	77. 65	372. 84	210. 92	4, 030. 22
Soda fountain.....	6, 222. 45	667. 33	1, 260. 55	2, 742. 43	38, 378. 25
Barber shop.....	1, 500. 30	78. 91	87. 19	112. 40	6, 799. 49
Pressing club.....	500. 47	35. 70	67. 95	3. 00	2, 178. 53
Instructions.....	114. 25				925. 55
Refunds.....	178. 50	80. 00	7. 50	40. 50	885. 25
Tournaments.....	785. 46	46. 85		32. 98	2, 360. 35
Cigars and candies.....	4, 554. 29	550. 90	590. 85	1, 493. 15	31, 517. 44
Motion pictures.....	780. 93	38. 10	315. 22	75. 77	3, 818. 15
Total.....	23, 592. 68	2, 514. 78	5, 013. 14	6, 357. 22	133, 086. 95

TABLE 30.—Statement of amounts paid, under act of May 30, 1908, to employees as compensation and on account of deaths of employees injured in the course of employment, and amounts paid under act of Feb. 24, 1909, for injuries lasting 15 days or less, amounts paid under Executive order of Feb. 26, 1913, and amounts paid under Executive order No. 1902, dated Mar. 20, 1914, covering period from Aug. 1, 1908, to June 30, 1914.

Total payments, by fiscal years to date.	Injuries.	Deaths.	Under act of Feb. 24, 1909.	Total.
Aug. 1, 1908, to June 30, 1909.....	\$32,355.71	\$3,682.79	\$8,225.16	\$44,263.66
July 1, 1909, to June 30, 1910.....	96,810.33	21,053.22	16,010.30	133,873.85
July 1, 1910, to June 30, 1911.....	168,416.23	35,248.39	49,957.80	253,622.42
July 1, 1911, to June 30, 1912.....	166,620.21	37,534.68	55,838.25	259,993.14
July 1, 1912, to June 30, 1913.....	150,943.79	23,792.02	49,335.91	224,071.72
July 1, 1913, to June 30, 1914.....	111,240.75	41,015.34	33,704.92	185,961.01
Total.....	726,387.02	162,326.44	213,072.34	1,101,785.80
Payments under Executive order of Feb. 26, 1913.....				7,808.71
Payments under Executive order of Mar. 20, 1914 (Apr. 1 to June 30, 1914).....				4,283.82
Payments made under special acts of Congress.....				31,207.38
Total.....				1,145,085.71

TABLE 31.—Statement of injuries sustained by employees of the Panama Canal, July 1, 1913, to June 30, 1914, for which compensation was due or claimed, under acts of Congress of May 30, 1908, and Feb. 24, 1909.

Injuries reported.....	1,097	All other cases, less than 15 days, estimated duration, days.....	8
Claims pending from last report.....	133	Reasons assigned for disapproval of injury claims:	
Claims for injuries:		Negligence and misconduct.....	10
Filed.....	1,082	Not in course of employment.....	30
Approved.....	975	Not employed by commission.....	1
Disapproved.....	148	Less than 15 days.....	4
Under 15 days, no allowance.....	90	Accident described not cause of incapacity.....	53
Pending.....	2	Failure to establish by sufficient evidence connection between alleged injury and incapacity.....	39
Accidental deaths reported.....	87	Incapacity caused by illness.....	11
Claims pending from last report.....	10	Reason for disapproval of death claims:	
Claims on account of death:		Not in course of employment.....	2
Filed.....	60	Not employed by commission.....	1
Approved.....	52	Not dependent parent within meaning of act.....	5
Disapproved.....	8		
Pending.....	10		
Under act of Feb. 24, 1909.....	3,610		
Total accidents reported.....	4,794		
Average duration of disability of cases for which claims have been filed, days.....	51		

TABLE 32.—Statement of amounts paid under Executive order No. 1902, dated Mar. 20, 1914, as compensation to employees injured while directly engaged in actual work, Apr. 1, 1914, to June 30, 1914.

Department or division.	April.	May.	June.	Total.
Mechanical—injury.....	\$188.26	\$399.45	\$320.23	\$907.94
General construction—injury.....	72.60	165.95	87.09	325.64
Supply:				
General—injury.....	35.52	56.89	181.45	273.86
Permanent buildings—injury.....	20.70	95.22	225.56	341.48
Fortifications—injury.....	47.08	134.38	177.99	359.45
Health—injury.....			3.25	3.25
Erection—injury.....	17.97	100.85	451.20	570.02
Dredging—injury.....	110.24	261.67	199.58	571.49
Terminals—injury.....	124.00	214.87	301.21	640.08
Transportation—injury.....	8.25	52.14	48.75	109.14
Municipal engineering—injury.....	11.05	54.37	53.05	118.47
Police and fire protection—injury.....	63.00			63.00
Total.....	698.67	1,535.79	2,049.36	4,283.82
Amounts allowed Panama R. R. employees.....	184.79	202.90	382.92	770.61

TABLE 33.—*Number of fatal and nonfatal accidents reported from each specified cause, for the fiscal years 1912-13 and 1913-14.*

Cause of injury.	1912-13		1913-14	
	Nonfatal.	Fatal.	Nonfatal.	Fatal.
Motors.....	3			
Power-transmission apparatus.....	2		6	1
Working machinery using power.....	87	1	58	1
Working machinery not using power.....	13		41	1
Elevators, hoists, cranes, etc.....	111	7	45	6
Steam boilers, piping explosions, etc.....	22		9	
Explosions of dynamite, powder, etc.....	50	7	6	4
Inflammable, poisonous, hot corrosive materials, gases, vapors, etc.....	27	2	18	
Electric current.....	9	2	2	
Collapse, fall, etc., of materials.....	249	8	153	19
Falls from stairs, ladders, scaffolding, etc., or into excavations.....	160	13	74	12
Falls on even surface.....	61		22	
Loading and unloading, lifting, carrying, etc.....	437	1	309	2
Vehicles (run over by carts, wagons, etc.).....	2		1	
Railway operations (run over, etc.).....	162	35	110	27
Animals (kicks, bites, etc.) and riding.....	6		2	
Shipping and water transportation.....	13	6	16	4
Flying bodies, splinters, etc.....	95		47	1
Hand tools and simple instruments.....	164		78	
Stepping on nails and similar sharp bodies.....	39		15	
Other causes.....	119	2	85	9
Causes not reported.....	2			
Total.....	1,833	84	1,097	87

TABLE 34.—*Number of compensated cases of nonfatal injuries for the fiscal years 1912-13 and 1913-14.*

Nature of injury.	1912-13	1913-14	Nature of injury.	1912-13	1913-14
Upper extremities:			Lower extremities—Contd.		
Loss of either arm, not specified.....		1	Loss of toe or toes.....	9	9
Loss of right arm.....	4	1	All other injuries to lower extremities.....	132	82
Fracture of arm or forearm.....	28	9	Combined injuries to lower and upper extremities:		
Other injuries to either arm or forearm.....	64	37	Including loss of any part.....	1	
Loss of hand, not specified.....			Including fractures.....	4	1
Loss of right hand.....		1	All other injuries to the extremities.....	27	1
Fracture of bones of hand.....	9	5	Trunk:		
Other injuries to hand.....	83	61	Fracture of ribs.....	10	6
Loss of one finger, right hand.....	17	19	Other chest injuries.....	9	3
Loss of one finger, left hand.....	19	17	Injuries to back.....	40	15
Loss of more than one finger, right hand.....	5	6	Hernia.....	140	119
Loss of more than one finger, left hand.....	1	2	Other abdominal injuries.....	6	7
Either hand, not specified.....	5	5	All other injuries to trunk.....	40	41
Fracture of fingers.....	81	34	Eyes:		
All other injuries to fingers.....	322	205	Loss of either eye.....	1	1
All other injuries to upper extremities.....	46	12	Other injuries to either eye.....	60	19
Lower extremities:			Loss of both eyes.....		1
Loss of either leg.....	7	5	Other injuries to both eyes.....	3	2
Loss of both legs.....	2	3	Head:		
Fracture of either thigh.....	1	1	Fracture of skull.....	8	5
Fracture of either leg.....	28	10	Fracture of other bones.....	3	
Fracture of both thighs or legs.....	6	1	Concussion of brain without fracture.....	1	
Other injuries to thighs or legs.....	216	116	All other injuries to head.....	30	27
Loss of foot.....	6	2	Neck: All injuries.....	5	
Fracture of bones of foot.....	17	8	Miscellaneous:		
Other injuries to foot.....	196	157	Internal injuries.....	9	
			Poisoning.....		
			All other injuries, including multiple injuries.....	127	36
			Not reported.....	5	4
			Total.....	1,833	1,097

TABLE 36.—Table of injuries for the period from Apr. 1 to June 30, 1914, Panama Canal employees.

Character of work at time of injury.	Cause of injury.																				Total.					
	Blow of hammer or other object.	Caught between two hard bodies.	Collapse of materials.	Contact with machinery.	Contact with rough edge or surface.	Contact with sharp instruments, splinters, etc.	Derailment of locomotive or other moving object.	Explosions (boilers, pipes, gases, etc.).	Electric current.	Fall from elevations.	Fall into excavations.	Fall on even surface.	Fall from cars, etc., or other moving body.	Flying bodies.	Hot metals, inflammable or corrosive substance.	Lifting, pushing, pulling.	Operating hand car.	Struck by flying object.	Struck by moving body (engines, cars, etc.).	Struck by falling body.		Struck by swinging or loose object.	Stepping on nails or other sharp instrument.	Using hand tools or other simple instruments.	Vapors, gases, or poisonous substance.	Other causes.
Aids to navigation.....	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	3
Air and water supply.....	3	10	1	1	4	4	1	1	1	6	1	4	1	1	1	9	1	3	3	3	17	8	1	1	3	16
Breakwaters, wharves, quays, etc.....	2	8	1	1	3	8	1	1	1	8	1	1	1	1	1	3	1	1	1	16	2	20	1	1	3	97
Building construction, repairing, etc.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	79
Drilling and blasting.....	1	1	1	1	1	3	1	1	1	1	1	4	1	1	1	6	1	1	1	2	15	4	4	1	1	45
Commissary, storehouses, etc.....	1	9	1	1	1	1	1	1	1	2	1	1	1	1	1	5	1	1	3	10	1	7	1	1	2	42
Dry docks and coaling plants.....	3	1	1	1	1	1	1	1	4	3	3	1	1	1	1	3	1	1	1	5	1	3	1	1	2	24
Electrical installation.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	1	5	1	1	1	1	1	16
Excavation, dry, by hand.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Excavations, dry, by machinery.....	3	11	1	9	3	3	1	1	1	3	7	3	1	1	1	9	1	8	15	9	5	5	1	1	4	92
Excavations, wet, dredging, sluicing.....	2	5	11	1	2	6	1	1	1	5	2	7	2	1	2	7	1	6	2	24	6	33	1	2	2	129
Field repairs to equipment, etc.....	2	5	11	1	2	6	1	1	1	5	2	7	2	1	2	7	1	6	2	24	6	33	1	2	2	129
Fortifications.....	2	5	11	1	2	6	1	1	1	5	2	7	2	1	2	7	1	6	2	24	6	33	1	2	2	129
Hotels, messes, operation.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Inspection, checking, field.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Loading and unloading.....	4	5	3	3	4	4	1	1	3	2	1	1	1	1	1	1	1	1	12	2	1	1	1	1	1	29
Locks and spillways.....	4	5	2	3	4	4	1	1	3	2	1	4	2	1	1	6	1	4	2	14	5	7	2	1	2	74
Municipal improvements.....	1	2	1	1	1	3	1	1	1	1	1	2	2	1	1	2	1	1	1	6	1	3	1	1	1	23
Office work, courts, etc.....	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	1	3	1	1	1	23
Plants, manufacturing, and repair.....	15	26	2	14	10	19	1	1	1	7	2	5	2	2	11	15	1	30	4	55	5	13	6	1	4	249
Policing, fire protection, etc.....	1	3	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
Sanitation, field work of.....	1	3	1	1	1	2	1	1	1	3	1	2	1	1	1	2	1	1	1	7	1	1	1	1	1	5
Tracks, construction and maintenance.....	1	3	1	1	1	3	1	1	1	3	1	2	1	1	1	2	1	1	1	4	2	3	1	1	1	22
Transportation, railway.....	1	3	1	1	1	3	1	1	1	3	1	2	1	1	1	2	1	1	1	4	2	3	1	1	1	50
Transportation, water.....	1	3	1	1	1	2	1	1	1	2	2	1	1	1	1	1	1	1	13	4	1	1	1	1	3	17
Transportation, other.....	1	3	1	1	1	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Quarters, operation of.....	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Total.....	36	98	22	32	26	57	10	2	10	46	21	33	17	4	17	73	2	70	30	209	47	119	16	4	32	1,033

TABLE 37.—Table of injuries for the period from Apr. 1 to June 30, 1914, Panama Railroad employees.

Cause of injuries.	Nature of injury.															Fatal.	Total.
	Loss of 1 hand, at or above the wrist joint, or complete loss of the use of 1 hand.	Loss of 1 foot, at or above the ankle joint, or complete loss of the use of 1 foot.	Loss of second finger.	Loss of fourth finger.	Fracture of the skull, both tables.	Fracture of the thigh.	Fracture of the foot.	Fracture of 2 or more fingers.	Burns.	Contusions and abrasions.	Cuts and punctures.	Hernias.	Injuries to eyes and ears.	Sprains.	All other cases of injury resulting in temporary disability.		
Blow of hammer or other object.....	1										1			2	4		5
Caught between 2 hard bodies.....					1					22					13		39
Collapse of material.....										4							4
Contact with machinery.....			1								1						1
Contact with rough edge or surface.....										3							3
Contact with sharp instruments, splinters, etc.....										5	4						9
Derailment of locomotive or other moving object.....										3				1			4
Fall from elevations.....										5					2		7
Fall into excavations.....										3							3
Fall on even surface.....										2				2			4
Fall from cars, etc., or other moving body.....										5		1					6
Hot metal, inflammables or corrosive substance.....									1								1
Lifting, pushing, pulling.....																	1
Struck by flying object.....														2			2
Struck by moving body (engines, cars, etc.).....		1								12	1		4	1	3		20
Struck by falling body.....						1				29	4				12	1	47
Struck by swinging or loose object.....										9	2				6		19
Stepping on nail or other sharp instrument.....											14						14
Using hand tools or other simple instruments.....											1						1
Vapors, gases, or poisonous substance.....									1								1
Other causes.....														3			3
Total.....	1	1	1	1	1	1	1	1	2	102	28	1	4	11	56	2	214

TABLE 38.—Table of injuries for the period from Apr. 1 to June 30, 1914, Panama Railroad employees.

Character of work at time of injury.	Cause of injuries.																				Total.	
	Blow of hammer or other object.	Caught between two hard bodies.	Collapse of material.	Contact with machinery.	Contact with rough edge or surface.	Contact with sharp instruments, splinters, etc.	Derailment of locomotive or other moving object.	Fall from elevations.	Fall into excavations.	Fall on even surface.	Fall from cars, etc., or other moving body.	Hot metals, inflammables, or corrosive substances.	Lifting, pushing, pulling.	Struck by flying object.	Struck by moving body (engine, cars, etc.).	Struck by falling body.	Struck by swinging or loose object.	Stepping on nail or other sharp instrument.	Using hand tools or other simple instruments.	Vapors, gases, or poisonous substances.		Other causes.
Air and water supply.....	3	15	2	2		4		3	4	1		1	4		4	24	13	5			1	86
Breakwaters, wharves, quays, etc.....																						1
Building construction, repairing, etc.....																						1
Commissaries, storehouses, etc.....						1																3
Dry docks and coaling plants.....		3				1									1	2	1					10
Electrical installation.....					1									3	1	1	1					11
Excavation, dry, by hand.....										1					1				1			3
Excavation, dry, by hand.....										1												2
Inspection, checking field.....											1				1	9	1					19
Loading and unloading.....		4	1		1			1			1				1							1
Lock and spillway construction.....																						2
Plants, manufacturing and repair.....						1		1														1
Policing, fire protection, etc.....																						1
Tracks, construction, maintenance.....		12						2	1	1			4	1		4			1			26
Transportation, railway.....	1	3			3		1			2	2			2	11	3	1		5			34
Transportation, water.....	1		1			1		1	2						1	2	1			1		11
Transportation, other.....																1						1
All other character of work.....		1														1						2
Total.....	5	39	4	2	5	9	1	8	7	7	3	1	10	6	20	47	19	16	1	1	3	214

TABLE 39.—Receipts, issues, and transfers of stores and purchases delivered directly to divisions during the 6 months ended June 30, 1914.

	January.	February.	March.	April.	May.	June.	Total.
Inventory, Jan. 1, 1914.....							\$3, 731, 765. 97
Receipts by—							
Purchase.....	\$715, 893. 75	\$610, 013. 65	\$669, 367. 73	\$662, 069. 93	\$703, 644. 94	\$1, 479, 255. 92	4, 840, 245. 92
Transfers from other stores.....	509, 529. 40	343, 298. 50	640, 506. 33	1, 314, 772. 41	571, 079. 75	934, 111. 10	4, 313, 297. 49
Manufacture.....	77, 776. 67	18, 196. 88	50, 487. 39	76, 442. 96	111, 584. 00	73, 818. 34	408, 306. 24
Adjustments.....		17, 652. 02	50, 896. 60		584. 32		69, 132. 94
Total to be accounted for.....							13, 362, 748. 56
Issues by—							
Foremen's orders.....	673, 107. 50	813, 226. 94	849, 850. 43	903, 578. 81	903, 904. 93	1, 279, 916. 80	5, 423, 585. 41
Transfers to other stores.....	348, 641. 07	246, 207. 83	539, 703. 85	1, 967, 592. 47	329, 887. 74	719, 181. 50	3, 391, 114. 46
Sales.....	46, 500. 32	17, 281. 56	12, 707. 84	34, 443. 98	13, 964. 39	17, 479. 47	142, 377. 56
Surveys and adjustments.....		8, 899. 80	40, 390. 28	20, 057. 52	2, 103. 23	608. 93	72, 059. 76
Total accounted for.....							9, 029, 137. 19
Stores on hand June 30, 1914.....							4, 333, 611. 37
Purchases to divisions.....	207, 669. 65	330, 204. 62	754, 349. 83	395, 944. 95	563, 017. 84	795, 998. 85	3, 047, 185. 74

TABLE 40.—*Panama Railroad commissary department—C. i. f. cost of material and supplies sold during the year ending June 30, 1914, and percentage of surcharge earned on same.*

	On hand July 31, 1914.	Purchases.	On hand June 30, 1914.	Sold.
Groceries.....	\$278,549.15	\$1,486,425.32	\$249,840.19	\$1,515,134.28
Hardware.....	90,409.74	127,674.79	74,909.02	143,175.51
Dry goods.....	415,511.78	818,313.39	356,342.37	877,482.80
Boots and shoes.....	118,188.64	225,743.38	86,092.09	257,839.93
Cold storage.....	91,879.11	2,165,898.60	94,724.42	2,163,053.29
Stationery and furniture.....	13,628.88	80,061.57	16,618.34	77,072.11
Tobacco.....	53,841.10	252,760.45	48,923.84	257,677.71
Raw material.....	86,511.61	332,585.87	47,788.55	371,308.93
Total.....	1,148,520.01	5,489,463.37	975,238.82	5,662,744.56

PERCENTAGE OF SURCHARGE EARNED ON COST.

	Sold.	Earned surcharge.	Percentage earned on cost.
Groceries.....	\$1,515,134.28	\$311,619.13	20.56
Hardware.....	143,175.51	45,328.22	31.66
Dry goods.....	877,482.80	312,947.27	35.66
Boots and shoes.....	257,839.93	57,024.30	22.11
Cold storage.....	2,163,053.29	114,824.84	5.31
Stationery and furniture.....	77,072.11	3,252.65	4.22
Tobacco.....	257,677.71	107,479.51	41.71
Total.....	5,291,435.63	952,475.92	18.00

LOCATION OF PURCHASES.

United States.....	\$4,287,615.30
Foreign.....	722,840.14
Local.....	452,282.12
Panama Canal.....	26,725.81
Total.....	5,489,463.37

CLASSIFICATION BY COMMODITIES.

Groceries.....	\$1,486,425.32
Hardware.....	127,674.79
Dry goods.....	818,313.39
Boots and shoes.....	225,743.38
Cold storage.....	2,165,898.60
Stationery and furniture.....	80,061.57
Tobacco.....	252,760.45
Raw material.....	332,585.87
Total.....	5,489,463.37

TABLE 41.—*Panama Railroad commissary department—Statement showing distribution of sales for the year ending June 30, 1914.*

	Commissary department.	Manufactur- ing plants.	Raw material.	Total.
Sales:				
To Panama Canal.....	\$1,401,784.11	\$190,113.54	\$34,738.11	\$1,626,635.76
To Panama Railroad.....	43,726.16	16,114.63	1,631.24	61,472.03
To individuals and companies.....	86,646.09	20,333.11	639.08	107,618.28
To United States Government.....	210,266.24	22,482.67	108.97	232,857.88
To steamship companies.....	3,853.70	6,919.93	6.35	10,779.98
To Panama Railroad restaurant.....	210.40	519.94	143.57	873.91
To Washington Hotel.....	24,024.79	6,916.47	882.93	31,824.19
On paid orders.....	44,389.67	82,578.58	774.08	127,742.33
For coupons.....	4,607,641.04	15,716.89	.....	4,623,357.93
Total.....	6,422,542.20	361,695.76	38,924.33	6,823,162.29
Supplied for equipment:				
To commissary for expense.....	64,568.13	69,803.73	33,212.36	167,584.22
To raw material for expense.....	55.96	976.68	294.61	1,327.25
For general expense.....	13,956.05	874.02	808.94	15,639.01
To plants for expense.....	.....	72,362.72	36,917.89	109,280.61
To equipment.....	2,178.59	.....	2,242.85	4,421.44
Total.....	80,758.73	144,017.15	73,476.65	298,252.53

TABLE 41.—*Panama Railroad Commissary department—Statement showing distribution of sales for the year ending June 30, 1914—Continued.*

	Commissary department.	Manufacturing plants.	Raw material.	Total.
Supplies:				
Condemned, lost in transit, shrinkage, etc.....				\$124,369.03
Total sales.....				7,245,783.85
Unaccounted for through pilfering, clerical errors, etc.....				25,333.43
Grand total.....				7,271,117.28
Average sales and issues per month.....		\$593,451.23		

TABLE NO. 42.—*Detailed statement of classified expenditures in department of civil administration and Canal Zone government for the fiscal year ending June 30, 1914, and total from beginning of work to date.*

	Zone funds.		Civil administration.		Grand total.	
	Total fiscal year 1914.	Total to June 30, 1914.	Total fiscal year 1914.	Total to June 30, 1914.	Total fiscal year 1914.	Total to June 30, 1914.
Administration.....			\$51,149.11	\$656,977.20	\$51,149.11	\$656,977.20
Supreme and circuit courts.....			31,759.28	396,429.00	31,759.28	396,429.00
Prosecuting attorney.....				39,558.47		39,558.47
District courts (old) magistrates.....	\$13,203.67	\$86,192.49			13,203.67	86,192.49
District court (new).....			3,349.14	3,349.14	3,349.14	3,349.14
District attorney.....			2,089.64	2,089.64	2,089.64	2,089.64
Canal Zone marshal.....			1,687.97	1,687.97	1,687.97	1,687.97
Division of revenues.....	3,774.95	61,949.29	11,459.46	196,019.21	15,234.41	257,968.50
Division of posts.....	58,473.17	502,886.93	113,814.52	846,424.08	172,287.69	1,349,311.01
Purchase of stamps.....	36,403.29	277,333.42			36,403.29	277,333.42
Division of customs.....			13,028.45	88,853.79	13,028.45	88,853.79
Division of lands and buildings.....				102,046.07		102,046.07
Division of estates.....			3,703.39	33,601.04	3,703.39	33,601.04
Police and prisons.....	8,230.07	69,717.74	262,830.84	2,525,523.86	271,060.91	2,595,241.60
Fire protection.....			96,557.71	892,311.04	96,557.71	892,311.04
Public schools.....	85,483.63	526,286.86			85,483.63	526,286.86
Construction of school-houses.....		98,095.97				98,095.97
Repairs of school houses.....	994.71	24,132.00			994.71	24,132.00
Sanitation.....	21,000.00	74,924.15			21,000.00	74,924.15
Zone charity.....	2,408.20	15,836.90			2,408.20	15,836.90
Maintenance and operation of water works and sewers:						
Panama.....			74,953.06	243,701.96	74,953.06	243,701.96
Colon.....			60,341.42	313,276.82	60,341.42	313,276.82
Repairs and maintenance of pavements:						
Panama.....			29,516.19	70,756.71	29,516.19	70,756.71
Colon.....			8,531.47	55,490.04	8,531.47	55,490.04
Miscellaneous Zone public works.....	1,214.73	62,532.85	707.56	34,150.52	1,922.29	96,683.37
Treasurer of Canal Zone.....			5,679.25	52,944.05	5,679.25	52,944.05
Construction of buildings.....	30.22	29,524.22	7.48	514,526.89	37.70	544,051.11
Repairs of buildings.....	150.24	12,518.08	5,317.88	25,075.05	5,468.12	37,593.13
Survey of lands, Canal Zone.....				75,000.00		75,000.00
Miscellaneous contingent.....	657.37	16,502.08			657.37	16,502.08
Construction of roads and trails.....	89,764.10	472,079.36			89,764.10	472,079.36
Maintenance of roads and trails.....	32,174.49	128,308.29			32,174.49	128,308.29
Construction, water works and sewers.....	19.63	51,612.59			19.66	51,612.59
Maintenance, water works and sewers.....	1,987.45	12,099.71			1,987.45	12,099.71
Total.....	355,940.63	2,522,532.93	776,483.82	7,169,792.55	1,132,424.45	9,692,325.48

Indicates credit.

APPENDIX H.

REPORT OF THE CHIEF HEALTH OFFICER, DEPARTMENT OF HEALTH.

CONTENTS.

	Page.
Letter of transmittal.....	376
General remarks.....	376
Vital statistics:	
Health of employees.....	376
Health of residents of the Canal Zone.....	377
Health of residents of the cities of Panama and Colon.....	377
Division of hospitals.....	377
Ancon Hospital.....	377
Colon Hospital.....	378
Line stations.....	378
Palo Seco Leper Asylum.....	378
Santo Tomas Hospital.....	379
Sanitary division:	
Canal Zone.....	379
Panama and Colon.....	379
Quarantine division:	
Panama and Colon.....	379
Remarks.....	380
Recommendations.....	381
Statistical tables:	
I. Deaths of employees and of the residents of Panama and Colon and the Canal Zone.....	381
II. Deaths, by age, color, and sex.....	382
III. Deaths, by nationality.....	382
IV. Causes of deaths of employees.....	382
V. Deaths of white Americans.....	383
VI. Causes and places of deaths of employees and civil population..	384
VII. Discharges and deaths of employees in hospitals of the Panama Canal.....	387
VIII. Consolidated hospital report.....	391
IX. Consolidated sick camp and sick-in-quarters report.....	392
X. Consolidated hospital, sick camp, sick-in-quarters, and dis- pensary report.....	392
XI. Employees: Constantly sick and noneffective rates per 1,000....	393
XII. Employees: Days' treatment per admission, hospitals, sick camps, and quarters.....	394
XIII. Subsistence and operating expenses.....	394
XIV. Outside patients treated in hospitals and amounts collected for their treatment.....	395
XV. Surgical operations performed in hospitals.....	395
XVI. Operations and work performed in eye, ear, nose, and throat clinics.....	396
XVII. Consolidated ward laboratory report of all hospitals.....	396
XVIII. Report of Ancon Hospital.....	397
XIX. Report of Colon Hospital.....	397
XX. Report of Palo Seco Leper Asylum.....	397
XXI. Report of Taboga Sanitarium.....	398
XXII. Report of Santo Tomas Hospital.....	398
XXIII. Report of Board of Health Laboratory.....	399
XXIV. Report of issues of quinine.....	399
XXV. Sanitary work done in Panama, Colon, and Canal Zone.....	399
XXVI. Quarantine transactions.....	401
XXVII. Personnel report.....	402
XXVIII. Hospital cases of malaria among employees.....	402

ANCON, CANAL ZONE, *July 27, 1914.*

SIR: I have the honor to submit a report of the operations of the department of health for the fiscal year ending June 30, 1914.

Very respectfully,

CHARLES F. MASON,
Chief Health Officer.

GENERAL REMARKS.

The work of the department has not decreased to the extent that was expected. This, of course, because the number of employees still remains very large.

There have been a few changes in the organization. On June 30, 1914, the Ancon Hospital laundry was turned over to the supply department, and the medical storehouse, which had been taken over by the supply department April 1, 1914, was returned to us.

The following changes have occurred in the personnel of this office:

Col. W. C. Gorgas, chief sanitary officer, having been appointed surgeon general of the Army, was relieved from duty March 31, 1914.

Col. John L. Phillips, assistant chief sanitary officer, was relieved from duty March 31, 1914.

Maj. Robert E. Noble, general inspector, was relieved from duty March 31, 1914.

Dr. J. C. Perry, chief quarantine officer, and health officer of Panama, was relieved from duty April 13, 1914.

Mr. J. A. Le Prince, chief sanitary inspector, resigned, effective March 25, 1914, and his office was consolidated with that of general inspector.

Lieut. Col. Chas. F. Mason was appointed chief health officer, relieving Col. Gorgas on April 1, 1914.

Dr. M. C. Guthrie was appointed chief quarantine officer April 1, 1914.

Maj. P. A. Ashburn was appointed general inspector, relieving Maj. Noble, April 21, 1914.

The name of the department was changed on April 1 from "Department of Sanitation" to "Department of Health," and the chief officer of the department from that of "Chief Sanitary Officer" to "Chief Health Officer."

The cost of the department has been reduced somewhat during the year, being \$1,254,298.30, as against \$1,595,514.37 for the fiscal year 1913.

EMPLOYEES.

The health of the employees and the other residents of the Canal Zone and the terminal cities has continued good throughout the year. The death rate for employees was 7.92 per thousand, as compared with 8.94 for 1913. The death rate of employees from disease alone, which is a better indication of sanitary conditions, was 5.17 for 1914, as compared with 5.91 for 1913.

The death rate of white employees from the United States, from disease, was 2.06 per thousand for 1914, as compared with 3.07 for 1913.

The constantly noneffective rate per thousand for employees was 14.01 for 1914, as compared with 19.04 for 1913.

The admission rate for malaria to hospitals for employees was 70 per thousand, as compared with 102 for 1913, and the death rate for the same disease was 0.31, as compared with 0.33 for 1913. This is the most important disease as a cause of disability which prevails among employees, and special efforts are made to control it.

Two cases of smallpox were brought to the Isthmus during the year; one on a ship from Callao, Peru, in November, 1913, and the other on a ship from San Francisco, in April, 1914. Both cases recovered. No cases of yellow fever or plague originated on or were brought to the Isthmus during the year.

DEPORTATIONS.

The following deportations were accomplished during the year:

	Disease.	Accident.	Total.
Employees.....	89	41	130
Nonemployees.....	44	1	45
Total.....	133	42	175

CANAL ZONE.

The total death rate for residents of the Canal Zone was 16.70, as compared with 16.10 for 1913. The death rate from disease in the cities of Panama and Colon and the Canal Zone was 23.48, as compared with 20.43 for 1913.

PANAMA AND COLON.

The total death rates for the cities of Panama and Colon were 36.14 and 25.55, respectively, as compared with 29.95 and 24.37 for 1913. The increased death rate in Panama is, in my opinion, not real but the result of a large increase in population, due to immigration from the Canal Zone, which increase can not be used for statistical purposes until it is verified by actual count.

DIVISION OF HOSPITALS.

There have been some reductions in the personnel of this division and the cost of the same during the year. The number of employees on June 30, 1913, was 868, and on June 30, 1914, 571. The cost of the division was \$947,285.30 for 1913 and for 1914, \$742,238.52.

ANCON HOSPITAL.

The average number of patients constantly present in Ancon Hospital for 1914 was 1,079, as compared with 1,119 for 1913.

The cost of the hospital for the year was \$614,529.21, as compared with \$527,176.52 for 1913.

During the year a number of the male insane in the hospital were transferred to the farm for disabled at Corozal, constituting a colony for work on the farm; this change has enabled the farm to dispense with all able-bodied employees except one, and at the same time has

improved the health and happiness of the patients themselves and given more room at the insane asylum proper.

The farm for the disabled, which was established at Corozal November 16, 1912, at the close of the year was caring for 54 men who had been permanently disabled from injuries received in the line of duty. The per capita cost of maintaining them has steadily decreased, and in a few years the farm should be self-supporting.

A new schedule of charges for the treatment of patients in the hospitals of The Panama Canal was put into effect on June 10, and is expected to considerably diminish the net cost of the operations of the hospitals. The basic principle of the new schedule is to treat all employees free, except those sick from alcoholism or venereal diseases; to care for the families of employees and those persons assimilated thereto, at cost to the hospital, and to charge outside pay patients a fair margin of profit.

The Tivoli Dispensary has been consolidated with Ancon Hospital, and its work is now done with practically no increase in the cost of the institution.

Plans and estimates are being prepared with a view to rebuilding Ancon Hospital on a permanent basis. The present temporary buildings are rapidly falling into decay, and a number of them must be replaced as soon as possible. It is proposed to construct the new buildings of concrete and tiles, and to ask Congress for an appropriation for this purpose of \$100,000 each year until the work is completed, those buildings to be replaced first which are most in need of reconstruction.

COLON HOSPITAL.

The plan to abolish Colon Hospital entirely has been changed, because it has been found necessary to always have at least a dispensary and facilities for emergency cases at that end of the canal. Arrangements have been made with the Panaman Government to receive and care for residents of Colon and vicinity in this hospital. Pay patients will be charged regular hospital rates, while the indigent sick will be charged for at cost price, bills being rendered against the Panaman Government.

The new hospital will be located in Cristobal, and plans and estimates have been made for a permanent concrete and iron building with a capacity of about 50 beds. As soon as this hospital is finished the present dispensary at Cristobal will be abolished and the work of the two institutions consolidated.

LINE STATIONS.

The number of our line stations has been reduced from 17 at the beginning of the year to 11 at its close, and the number of line physicians from 28 to 13. It is hoped to close the stations at Culebra, Empire, and Naos Island, before the end of the present calendar year, and possibly one or two others before the end of the fiscal year.

PALO SECO LEPER ASYLUM.

There have been no changes of note in this institution during the year.

SANTO TOMAS HOSPITAL.

This institution also remains on practically the same basis.

ZONE SANITATION.

The number of sanitary inspection districts has been reduced during the year from 15 to 9. The cost of the division in 1914 was \$246,839.21, as compared with \$402,125.14 in 1913.

Our aim in Zone sanitation at the present time is to do only such work as is absolutely necessary in districts which will soon be abandoned, and to do work of a permanent character, such as will require little maintenance, in the permanent settlements.

HEALTH OFFICES, PANAMA AND COLON.

In September, 1913, the work of street cleaning and garbage removal in the city of Panama, which had theretofore been done by the Panaman Government, and to which the Isthmian Canal Commission had contributed \$10,000 each year, was taken over by the health department because the work had been done in such an unsatisfactory manner. Under the new arrangement the Panaman Government will pay us \$38,000 a year and we will contribute \$10,000 or such part of that sum as may be necessary in order to do the work.

The most important objects of our work in the sanitation of Panama and Colon at present are to render these cities as rat proof as possible in order that if plague should obtain an entrance through quarantine it could not spread. To this end houses are being reconstructed with concrete floors and single walls; old wooden piers are being condemned with a view to destruction and replacement by permanent concrete and iron structures; yards, patios, alleys, and areaways are being cleaned up so as to furnish no food or nesting places for rats; and stables and other places frequented by rats are being put in proper sanitary condition.

Because of their disease-carrying proclivities, a special war has been made upon the plague of flies in Panama city.

As you know, the cost of the sanitary work done in the cities of Panama and Colon, as well as a share of the expenses of street cleaning and garbage removal, is borne by the Canal Government. In my opinion, the Panaman Government ought hereafter to bear these expenses itself, but the work should be done by us, as experience has shown that otherwise it is not done well.

QUARANTINE DIVISION.

The cost of this division was, in 1913, \$62,374.46, and in 1914, \$52,502.99.

As soon as the canal comes into use the work of this division will steadily increase, and large expansion in personnel and costs may be expected. New and enlarged quarantine stations should be provided at both terminals of the canal. The site of the new quarantine station on the Balboa dumps has been selected, laid out, and assigned. It is proposed to move the present quarantine buildings from Culebra Island to this station as soon as practicable and to add more buildings as they become necessary.

At the Atlantic end, the site of the old Colon Hospital has been assigned for a quarantine station, and the old buildings there will be fixed up for temporary use. Inasmuch as the quarantine stations are a permanent feature and the old buildings will not last much longer, I would recommend that Congress be asked for an appropriation of \$200,000 to rebuild both stations.

REMARKS.

One of the most urgent problems which confronts us at present is to make proper provision for the care of indigents of the Canal Zone, both those that are sick and those who, not being sick, are through age or misfortune unable to care for themselves.

At present those employees who have been permanently disabled while on duty are cared for on the farm at Corozal, while a number of others who have been disabled either from disease or through injury not in line of duty are taken care of in the chronic ward at Colon Hospital. Then there are a large number of charity patients, both white and black, who are treated in Ancon Hospital proper and its insane department, and at Palo Seco. The total number of each of these classes on June 30, 1914, was:

Corozal farm (employees permanently disabled in line of duty).....	54
Colon Hospital chronic ward (chronics from disease, or injury while not on duty)..	26
Ancon Hospital proper, charity patients.....	29
Ancon Hospital, insane asylum, charity patients.....	76
Palo Seco Leper Asylum, charity patients.....	17

One of the difficulties of the situation is that frequently a sick or insane patient is brought to the hospital who has been on the Isthmus only a few days or weeks, indicating that there is an apparent effort to unload this class of undesirables upon the Panama Canal government. I do not know of any way of keeping out these pauper and undesirable immigrants except by making it compulsory upon the steamship companies who bring in these undesirables to return them to their own countries at the expense of the company.

At present we have absolutely no provision for taking care of indigents who are not sick or insane, and two or three cases of this class have come up recently. I believe Congress should be asked to make a special appropriation to cover the care of the indigents of the Canal Zone.

It is proposed to move the insane to the Corozal farm as soon as that station is abandoned as a residence for employees. The idea is to convert the buildings left at the abandoned station for use as the insane asylum. Of course, such buildings will be very unsatisfactory for that purpose and will not last many years at best. The question of building a permanent insane asylum with modern improvements, and to be run on the principle of the "open door," should be given consideration.

A large majority of our patients in the insane department are Panamanians and paid for at a flat rate by the Panaman Government. If we are to build a permanent institution we should first have an understanding with the Panaman Government by which our arrangement with them, for the care of their insane, will be permanent, or otherwise we might go to considerable expense to erect buildings far beyond our own immediate or prospective needs.

Every effort should be made to deport to their own countries all those charity insane who are ex-employees of The Panama Canal and Panama Railroad. There are a large number of these whose home Governments have already agreed to receive them, but we have been unable to get them away because the steamship companies refuse to take them. I believe that it would pay The Panama Canal to make special arrangements for sending them all at one time; perhaps a Navy transport or hospital ship might be obtained for this purpose, and this would possibly be the most expeditious and economical method of disposing of them.

RECOMMENDATIONS.

(1) That the Panaman Government be required to bear the entire cost of sanitation and street cleaning in Panama and Colon, but that the work be left in the hands of the health department.

(2) That the three physicians and three nurses at Santo Tomas Hospital, maintained at the expense of The Panama Canal, be continued, as it is very necessary for our protection that we should retain control of the administration and supervision of this hospital.

(3) That Congress be asked to make an appropriation of \$150,000 to construct a hospital at either Colon or Cristobal, and an additional appropriation of \$100,000 each year to reconstruct Ancon Hospital, beginning at once.

(4) That an appropriation of \$200,000 be asked for to rebuild the quarantine stations at Colon and Balboa.

(5) That a special appropriation be asked for for the care of Canal Zone paupers.

STATISTICAL TABLES, FISCAL YEAR 1913-14.

TABLE I.—Deaths of employees of The Panama Canal and Panama Railroad Co.

Color.	Average number of employees.	Total number of deaths from—		All causes.	Annual death rate per 1,000.		All causes.
		Disease.	Violence.		Disease.	Violence.	
White.....	9,384	29	32	61	3.09	3.41	6.50
Colored.....	42,868	241	112	353	5.62	2.61	8.23
Total.....	52,252	270	144	414	5.17	2.75	7.92

DEATHS IN THE CITIES OF PANAMA AND COLON, AND THE CANAL ZONE.

Place.	Population.	Deaths.	Annual average per 1,000.
Panama.....	47,172	1,705	36.14
Colon.....	20,232	517	25.55
Canal Zone.....	57,955	968	16.70
Total.....	125,359	3,190	25.45

NOTE.—The figures relating to the number of employees are compiled from the pay rolls of the different months of the year. The population and deaths as given for the cities of Panama, Colon, and the Canal Zone include employees and civil population.

Total admissions of employees to hospitals and sick camps, including those sick in quarters..... 24,723
Average per thousand of admissions of employees to hospitals and sick camps, including those sick in quarters..... 473

TABLE II.—Deaths by age, color, and sex.

Age.	White.			Colored.			Yellow.			Total.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
Under 1 year.....	59	53	112	544	408	952	4	1	5	607	462	1,069
1 to 4 years.....	18	12	30	117	124	241	3	.....	3	138	136	274
5 to 10 years.....	6	4	10	20	20	40	.....	.....	.....	26	24	50
11 to 20 years.....	12	8	20	48	51	99	.....	.....	.....	60	59	119
21 to 30 years.....	50	22	72	369	176	545	12	1	13	431	199	630
31 to 40 years.....	48	19	67	229	134	363	12	1	13	289	154	443
41 to 50 years.....	28	14	42	138	73	211	7	1	8	173	88	261
51 to 60 years.....	21	7	28	72	33	105	2	0	2	95	40	135
61 to 70 years.....	13	7	20	41	22	63	3	0	3	57	29	86
71 to 80 years.....	2	5	7	9	17	26	3	1	4	14	23	37
81 to 90 years.....	3	5	8	3	4	7	.....	.....	.....	6	9	15
91 to 100 years.....	1	1	2	.....	1	1	.....	.....	.....	.....	2	2
Unknown.....	11	.....	11	51	7	58	.....	.....	.....	62	7	69
Total.....	271	157	428	1,641	1,070	2,711	46	5	51	1,958	1,232	3,190

TABLE III.—Deaths by nationality.

Nations.	Em- ployees.	Nonem- polyees.	Total.	Nations.	Em- ployees.	Nonem- ployees.	Total.
Africa.....	.....	3	3	Japan.....	.....	2	2
Antigua.....	10	13	23	Martinique.....	21	63	84
Austria.....	.....	1	1	Mexico.....	.....	10	10
Bahama Islands.....	1	2	3	Montserrat.....	5	7	12
Barbados.....	103	326	429	Nassau.....	1	2	3
Belgium.....	.....	2	2	Nevis.....	2	.....	2
Central America.....	.....	1	1	Nicaragua.....	1	3	4
Chile.....	.....	1	1	Panama.....	12	1,358	1,370
China.....	.....	44	44	Peru.....	3	6	9
Colombia.....	10	86	96	Russia.....	1	1	2
Costa Rica.....	1	8	9	Saba.....	1	.....	1
Cuba.....	4	3	7	Salvador.....	1	3	4
Demerara.....	2	5	7	Santo Domingo.....	.....	1	1
Denmark.....	.....	1	1	St. Kitts.....	1	1	2
Dominica.....	1	7	8	St. Lucia.....	5	46	51
Ecuador.....	1	7	8	St. Thomas.....	.....	1	1
England.....	1	4	5	St. Vincent.....	11	6	17
Fortune Islands.....	1	1	2	Spain.....	16	30	46
France.....	.....	12	12	Sweden.....	1	.....	1
Germany.....	.....	1	1	Switzerland.....	1	.....	1
Greece.....	3	2	5	Trinidad.....	5	14	19
Grenada.....	7	17	24	Turks Island.....	1	.....	1
Guadeloupe.....	4	18	22	United States.....	30	50	80
Guiana, British.....	1	2	3	Venezuela.....	1	7	8
Guatemala.....	.....	1	1	West Indies.....	.....	14	14
Haiti.....	2	3	5	Unknown.....	3	16	19
India.....	2	4	6	Total.....	414	2,776	3,190
Italy.....	4	18	22				
Jamaica.....	133	542	675				

TABLE IV.—Causes of deaths of employees of The Panama Canal and Panama Railroad.

Causes of death.	White.	Colored.	Total.	Causes of death.	White.	Colored.	Total.
DISEASE.				DISEASE—continued.			
Alcoholism, acute and chronic.....	2	.....	2	Diabetes.....	1	.....	1
Aneurism.....	1	4	5	Diarrhea and enteritis.....	.....	1	1
Angina pectoris.....	.....	1	1	Diphtheria.....	.....	1	1
Apoplexy.....	2	8	10	Drug habit.....	1	.....	1
Appendicitis.....	1	.....	1	Dysentery:			
Arteriosclerosis.....	.....	2	2	Bacillary.....	.....	2	2
Brain, softening of.....	.....	2	2	Unclassified.....	.....	5	5
Cancer of buccal cavity.....	.....	1	1	Empyema.....	1	1	2
Cancer of intestines.....	.....	1	1	Encephalitis.....	1	.....	1
Cancer of the stomach and liver.....	1	2	3	Endocarditis, acute and chronic.....	.....	3	3
Carbuncle.....	1	.....	1	Fever:			
Cerebrospinal fever.....	.....	1	1	Hemoglobinuric.....	2	.....	2
				Malaria.....	.....	2	2

TABLE IV.—*Causes of deaths of employees of The Panama Canal and Panama Railroad—Continued.*

Causes of death.	White.	Colored.	Total.	Causes of death.	White.	Colored.	Total.
DISEASE—continued.				DISEASE—continued.			
Fever—Continued.				Pyelo-nephrosis.....		2	2
Malaria, estivo-autumnal.....	4	7	11	Septicemia, purulent infection and.....		7	7
Malaria, tertian.....		1	1	Stomach, disease of.....		2	2
Typhoid.....		4	4	Syphilis.....		2	2
Heart, organic disease of.....	3	17	20	Tetanus.....	1	1	2
Hernia, intestinal obstruction.....		1	1	Tuberculosis:			
Intestines, diseases of.....		1	1	Abdominal.....		1	1
Intestinal obstruction.....		2	2	Disseminated.....	1	24	25
Larynx, disease of.....		1	1	Miliary.....		4	4
Liver, abscess of.....	1	5	6	Pulmonary.....	1	32	33
Liver, cirrhosis of.....		1	1	Ulcer of stomach.....		2	2
Lungs, gangrene of.....		1	1	Duodenal.....		1	1
Meningitis:				Undiagnosed.....	1		1
Pneumococcus.....		2	2	VIOLENCE.			
Simple.....		2	2	Accidental traumatisms, various.....	3	27	30
Nephritis:				Drowning, accidental.....	7	33	40
Acute.....		1	1	Dynamite explosions.....	3	10	13
Chronic.....	3	27	30	Electric shock.....	4		4
Other diseases of the nervous system.....		1	1	Homicides.....	1	2	3
Peritonitis, simple.....		4	4	Railroad accidents.....	12	32	44
Pneumonia.....		3	3	Suicides.....	2	1	3
Lobar.....		47	47	Other external violence.....		1	1
Pyemia.....		1	1	Total.....	61	353	414
Pyemia and septicemia, pneumococcic.....		3	3				

TABLE V.—*Death rate among Americans on the Isthmus.*

	Number of deaths.	Annual average per 1,000.
Average number of white employees from the United States (5,824):		
Disease.....	12	2.06
Violence.....	14	2.40
All causes.....	26	4.46
Average number of white women and children from the United States (4,164):		
Disease.....	17	4.08
Violence.....	3	.72
All causes.....	20	4.80
Average number of white employees and their families from the United States (9,988):		
Disease.....	29	2.90
Violence.....	17	1.70
All causes.....	46	4.60
Total number of Americans on the Canal Zone (11,650): ¹		
Disease.....	31	2.66
Violence.....	24	2.06
All causes.....	55	4.72

NOTE.—¹ The figures representing the total number of Americans on the Canal Zone include employees and their families and the officers and men of the Tenth Infantry and Marine Corps and their families.

TABLE VI.—*Causes and places of deaths of employees and civil population.*

	Diseases.	Ancon Hospital.	Colon Hospital.	Panama.	Colon.	Zone.	Total.
I. General diseases.							
1	Typhoid fever.....	9		7		1	17
1c	Paratyphoid fever.....	1					1
4	Malaria.....		2	28	17	14	61
	Malarial fever:						
4a	Estivoautumnal.....	21	4	45	2	5	77
4b	Tertian.....	1		2	2		5
4e	Undetermined.....	1		2			3

TABLE VI.—*Causes and places of deaths of employees and civil population—Continued.*

	Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pan- ama.	Colon.	Zone.	Total.
I. General diseases—Continued.							
Malarial fevers—Continued.							
4f	Clinical.....			1	2		3
4g	Cachexia.....	1		4	1		6
4h	Hemoglobinuric fever, malarial.....	2					2
7	Scarlet fever.....			3			3
8	Whooping cough.....			1		1	2
9	Diphtheria and croup.....	1		3			4
9a	Croup.....			1		3	4
14	Dysentery.....	1		22		3	26
14a	Entamoebic.....	1		4			5
14b	Bacillary.....	1	1				2
14c	Unclassified.....	9	2				11
17	Leprosy.....		1	1			2
20	Purulent infection and septicemia.....	15		3			18
20a	Pyæmia.....	3					3
20b	Septicemia.....	7	1	12		3	23
20c	Pymia and septicemia, pneumococcic.....	4					4
24	Tetanus.....	6	1	17	1	2	27
26	Pellagra.....	6	5	27			38
27	Beriberi.....		1	11			12
28	Tuberculosis of the lungs.....	50	16	194	30	19	309
29	Acute miliary tuberculosis.....	6				3	9
30	Tuberculous meningitis.....	1			1		2
31	Abdominal tuberculosis.....	3		3			6
32	Pott's disease.....			1			1
Tuberculosis of—							
33a	Bones and joints.....			1			1
34a	The larynx.....			3			3
35	Disseminated tuberculosis.....	51	2	1		2	56
36	Rickets.....	1		1		1	3
Syphilis:							
37B	Secondary.....			1			1
37C	Tertiary.....	9		1			10
37D	Hereditary.....	1	1	9	4	5	20
37E	Period not stated.....	1		6			7
38Aa	Gonorrhea.....			1			1
38Ab	Arthritis.....	1	1				2
39	Cancer and other malignant tumors of the buccal cavity.....	1		1	1		3
40	Cancer and other malignant tumors of the stomach and liver.....	5	2	5		1	13
41	Cancer and other malignant tumors of the peritoneum, intestines, rectum.....	1	1	1			3
42	Cancer and other malignant tumors of the female genital organs.....	1		5	3		9
45	Cancer and other malignant tumors of other organs and of organs not specified.....	1		12			13
46	Other tumors (tumors of the female genital organs excepted).....					1	1
47	Acute articular rheumatism.....			3			3
49	Scurvy.....	2		1	1		4
50A	Diabetes.....		1	1			2
51	Exophthalmic goiter.....				1		1
54	Anemia, chlorosis.....					1	1
54a	Chlorosis.....			1			1
Anemia:							
54b	Primary, pernicious.....			4	2	1	7
54c	Secondary, cause not determined.....			6		1	7
55	Other general diseases.....			2			2
Alcoholism:							
56	Acute or chronic.....	3	1	1			5
56a	Acute.....	2	1	1			4
56b	Chronic.....			3	2		5
56c	Alcoholic psychosis.....	1		1			2
59a	Drug habit.....			1		2	3
II. Diseases of the nervous system and of the or- gans of special sense.							
60	Encephalitis.....	2	1	2	1	1	7
61	Simple meningitis.....	4	5	20	2	3	34
61a	Cerebrospinal fever.....	3		3			6
61b	Pneumococcus meningitis.....	2					2
62	Locomotor ataxia.....			1			1
63	Other diseases of the spinal cord.....	1					1
63a	Acute anterior poliomyelitis.....			1			1
64	Cerebral hemorrhage, apoplexy.....	6	3	32	13	8	62
65	Softening of the brain.....	4	1				5

TABLE VI.—*Causes and places of deaths of employees and civil population—Continued.*

	Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pan- ama.	Colon.	Zone.	Total.
II. Diseases of the nervous system and of the organs of special sense—Continued.							
66	Paralysis without specified cause.....		1	2	1	1	5
67	General paralysis of the insane.....	3					3
68	Other forms of mental alienation.....	2					2
69	Epilepsy.....			4		1	5
70	Convulsions (nonpuerperal) (5 years and over).....			2			2
71	Convulsions of infants (under 5 years of age).....			8	8	12	28
73C	Neuritis.....			1			1
74	Other diseases of the nervous system.....	2					2
74a	Tumor of the brain.....	1					1
74b	Neurasthenia.....				1		1
75	Diseases of the eyes and their annexa.....				1		1
76	Diseases of the ears.....			1			1
III. Diseases of the circulatory system.							
78	Acute endocarditis.....	1		20	1	2	24
78a	Malignant endocarditis.....	1	2	2			5
79	Organic diseases of the heart.....	41	7	37	12	17	114
80	Angina pectoris.....			2	1	2	5
81	Diseases of the arteries, atheroma, aneurism, etc.....			1			1
81a	Aneurism.....	7		3		2	12
81b	Arteriosclerosis.....	7		13			20
82	Embolism and thrombosis.....			4	1	1	6
83	Diseases of the veins (varices, hemorrhoids, phlebitis, etc.).....	1					1
85	Hemorrhage; other diseases of the circulatory system.....			4	2		6
IV. Diseases of the respiratory system.							
87	Diseases of the larynx.....		1		1	1	3
87a	Laryngitis.....			1			1
89	Acute bronchitis.....			38	27	7	72
90	Chronic bronchitis.....			3	7	2	12
91	Bronchopneumonia.....	10	8	46	26	47	137
92A	Pneumonia (unqualified).....			74	4	9	87
92B	Lobar pneumonia.....	58	9	28	2	10	107
93A	Pleurisy.....	1		8	1	1	11
93B	Empyema.....	3		2			5
94	Pulmonary congestion, pulmonary apoplexy.....			9	1	1	11
95	Gangrene of the lungs.....	4					4
96	Asthma.....			2		1	3
97	Pulmonary emphysema.....				1		1
98	Other diseases of the respiratory system (tuberculosis excepted).....	1		3		1	5
V. Diseases of the digestive system.							
99	Diseases of the mouth and annexa.....	2					2
99b	Stomatitis.....					2	2
102	Ulcer of the stomach.....	1				1	2
103	Other diseases of the stomach (cancer excepted).....		1	1		1	3
103b	Acute gastritis.....			2	7	8	17
103c	Chronic gastritis.....			1	3		4
104	Diarrhea and enteritis (under 2 years).....	25		229	27	61	342
104a	Colitis.....	6	1	28		7	42
105	Diarrhea and enteritis (2 years and over).....	5		7	5	4	21
105a	Colitis.....	2		5		2	9
106	Ankylostomiasis.....	1	1			2	4
107	Intestinal parasites.....			2	1		3
107a	Ascariasis.....			1			1
108	Appendicitis and typhlitis.....	3				1	4
108a	Acute appendicitis.....			3			3
109	Hernia, intestinal obstructions.....	2	3				5
109c	Intestinal obstruction.....	2	1	9			12
110	Other diseases of the intestines.....	4		2	2		8
110b	Duodenal ulcer.....	1					1
111	Acute yellow atrophy of the liver.....			2			2
113	Cirrhosis of the liver.....	1		16	2	1	20
115	Other diseases of the liver.....	1		8	1		10
115a	Abscess of liver (unqualified).....	3	1	4			8
115b	Abscess of the liver entamebic.....	7					7
117	Simple peritonitis (nonpuerperal).....	1	5	9	2	4	21
118	Other diseases of the digestive system (cancer and tuberculosis excepted).....					1	1

TABLE VI.—Causes and places of deaths of employees and civil population—Continued.

	Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pan- ama.	Colon.	Zone.	Total.
VI. Nonvenereal diseases of the genito-urinary system and annexa.							
119	Acute nephritis.....	2		45	9	4	60
120	Bright's disease (chronic nephritis).....	34	9	64	14	9	130
122	Other diseases of the kidney and annexa.....	1				2	3
122c	Pyelonephrosis.....	3	1			3	7
124a	Cystitis.....		1				1
125	Diseases of the urethra, urinary abscess, etc.....	1		4			5
126b	Chronic prostatitis.....			1			1
129	Uterine tumor (noncancerous).....	1		4			5
130	Other diseases of the uterus.....	1		2			3
131	Cysts and other tumors of the ovary.....			2			2
132	Salpingitis and other diseases of the female genital organs.....	1		2			3
VII. The puerperal state.							
134B	Accidents of pregnancy.....	1				1	2
134Ba	Extra-uterine pregnancy.....	1	1	1			3
134Bb	Hyperemesis gravidarum.....				1		1
135	Puerperal hemorrhage.....	2	1	1	1		5
137	Puerperal septicemia.....	3		6	1	3	13
138	Puerperal albuminuria and convulsions.....				1		1
138a	Eclampsia.....	1	2	6	2	3	14
139	Puerperal phlegmasia alba dolens, embolus, sudden death.....			1			1
140	Following childbirth (not otherwise defined).....		1	2		2	5
140a	Puerperal insanity.....				1		1
VIII. Diseases of the skin and of the cellular tissues.							
142	Gangrene.....	1		5			6
143a	Carbuncle.....		1				1
144	Acute abscess.....			2			2
144a	Phlegmon and cellulitis.....				1		1
145E	Pemphigus contagiosus.....			1			1
IX. Diseases of the bones and of the organs of locomotion.							
146	Diseases of the bones (tuberculosis excepted).....			2			2
146a	Caries (nontuberculous).....			1			1
146c	Osteomyelitis.....			2			2
147	Diseases of the joints (tuberculosis and rheumatism excepted).....			1			1
X. Malformations.							
150	Congenital malformations (stillbirth not included).....	1		1	1		3
XI. Diseases of early infancy.							
151A	Newborn child.....	1				4	5
151B	Congenital debility, icterus, and sclerema.....			3	5	7	15
151Ba	Premature birth.....	4	1	26	4	15	50
151Bb	Congenital debility.....	8		19	20	14	61
151Bd	Malnutrition.....	6	3	53	22	81	165
152	Other causes peculiar to early infancy (including various consequences of labor).....		1	21	3	10	35
153	Lack of care.....			1	1		2
XII. Old age.							
154	Senility.....	2		4	1	7	14
XIII. Affections produced by external causes.							
155	Suicide by poisoning.....	1		3		1	5
157	Suicide by hanging or strangulation.....					1	1
159	Suicide by firearms.....			10	1	2	13
160	Suicide by cutting or piercing instruments.....				1	1	2
165	Other acute poisonings.....	2					2
167	Burns (conflagration excepted).....	3		3			6
168	Absorption of deleterious gases (conflagration excepted).....					1	1
169	Accidental drowning.....		1	3		54	58

TABLE VI.—*Causes and places of deaths of employees and civil population—Continued.*

	Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pan- ama.	Colon.	Zone.	Total.
	XIII. Affections produced by external causes— Continued.						
170	Traumatism by firearms.....			2		2	4
171	Traumatism by cutting or piercing instruments.....					1	1
172	Traumatism by fall.....	10	3		1	7	21
173	Traumatism in mines and quarries.....					9	9
174	Traumatism by machines.....	1	1			4	6
175	Traumatism by other crushings (vehicles, rail- roads, landslides, etc.).....	3		4		3	10
175a	Railroad traumatism.....	14	3	3		31	51
175b	Dynamite traumatism.....	2		9		2	13
175c	Traumatism by landslides.....					1	1
176	Injuries by animals.....	1					1
177	Starvation.....	1					1
181	Electricity (lightning excepted).....	1				4	5
182	Homicide by firearms.....	1		12	1		14
183	Homicide by cutting or piercing instruments.....	1		2	1	1	5
184	Homicide by other means.....	1	1	3		1	6
185A	Fractures (cause not specified).....			7			7
186	Other external violence.....	1				2	3
	XIV. Ill-defined diseases.						
187	Ill-defined organic disease.....	1				1	2
188	Sudden death.....			3	1	4	8
189A	Cause of death not specified or ill-defined.....	9		10		10	29
189Aa	Infections of undetermined origin.....	8		3		4	15
	Totals.....	599	126	1,531	328	606	3,190
	Stillbirths.....	7	8	205	75	97	392
	Grand totals.....	606	134	1,736	403	703	3,582

NOTE.—The deaths occurring in Ancon and Colon hospitals resulting from illness, injury, or other cases admitted from the cities of Panama and Colon, or from the Canal Zone, are in the table of vital statistics, credited to the places from whence they were admitted.

TABLE VII. *Table showing discharges and deaths of employees in the hospitals of The Panama Canal, from all causes, for the fiscal year 1913-14.*

	Diseases.	Dis- charged.	Died.
	I. General diseases.		
1	Typhoid fever.....	39	3
3	Relapsing fever.....	2	
	Malarial fever:		
4a	Estivoautumnal.....	2,235	10
4b	Tertian.....	428	
4c	Quartan.....	34	
4d	Mixed.....	2	
4e	Undetermined.....	3	
4f	Clinical.....	932	
4g	Cachexia.....	2	
4h	Hemoglobinuric fever, malarial.....	5	2
5b	Vaccinia.....	3	
6	Measles.....	9	
7	Scarlet fever.....	2	
9	Diphtheria and croup.....	5	1
10	Influenza.....	278	
14	Dysentery.....	8	
14a	Entamoebic.....	23	1
14b	Bacillary.....	4	2
14c	Unclassified.....	49	4
17	Leprosy.....	3	
18	Erysipelas.....	13	
19A	Dengue.....	4	
19B	Chicken pox.....	13	
19D	Mumps.....	6	
19E	Hemoglobinuric fever, unqualified.....	3	
19F	Yaws.....	5	
19K	Filariasis.....	5	

TABLE VII.—Table showing discharges and deaths of employees in the hospitals of The Panama Canal, from all causes, for the fiscal year 1913-14—Continued.

	Diseases.	Dis- charged.	Died.
I. General diseases—Continued.			
20	Purulent infection and septicemia.....	18	6
20a	Pyemia.....	2	1
20b	Septicemia.....	1	
20c	Pyemia and septicemia, pneumococci.....		3
24	Tetanus.....		2
26	Pellagra.....	3	
28	Tuberculosis of the lungs.....	103	50
29	Acute miliary tuberculosis.....		4
30	Tuberculous meningitis.....		1
31	Abdominal tuberculosis.....	3	1
32	Pott's disease.....	5	
33a	Tuberculosis of bones and joints.....	8	
34	Tuberculosis of other organs.....		1
34c	Tuberculosis of the lymph glands.....	5	
34d	Tuberculosis of the genitourinary organs.....	1	
35	Disseminated tuberculosis.....		25
	Syphilis:		
37A	Primary.....	15	
37B	Secondary.....	95	
37C	Tertiary.....	145	2
37D	Hereditary.....	25	
37E	Period not stated.....	193	
38A	Gonococcus infection.....	65	
38Aa	Gonorrhea.....	324	
38Ab	Gonorrheal arthritis.....	39	
38Ac	Gonorrheal bubo.....	23	
38Ad	Gonorrheal orchitis and epididymitis.....	60	
38Ae	Gonorrheal ophthalmia.....	6	
38B	Soft chancre.....	328	
38Ba	Adenitis chancroidal.....	78	
39	Cancer and other malignant tumors of the buccal cavity.....	1	
40	Cancer and other malignant tumors of the stomach and liver.....	2	3
41	Cancer and other malignant tumors of the peritoneum, intestines, rectum.....	3	1
42	Cancer and other malignant tumors of the female genital organs.....	2	
44	Cancer and other malignant tumors of the skin.....	3	
45	Cancer and other malignant tumors of other organs and of organs not specified.....	2	
46	Other tumors (tumors of the female genital organs excepted).....	26	
47	Acute articular rheumatism.....	7	
48	Chronic rheumatism and gout.....	1	
48a	Gout.....	1	
50A	Diabetes.....		1
	Anemia:		
54b	Primary, pernicious.....	3	
54c	Secondary, cause not determined.....	19	
55	Other general diseases.....	6	
55a	Serum disease.....	1	
55b	Purpura hemorrhagica.....	1	
	Alcoholism:		
56	Acute or chronic.....	10	1
56a	Acute.....	42	
56b	Chronic.....	12	
56c	Alcoholic psychosis.....	6	1
57	Chronic lead poisoning.....	3	
59	Other chronic poisonings.....	1	
II. Diseases of the nervous system and of the organs of special sense.			
61	Simple meningitis.....		2
61b	Pneumococcus meningitis.....		2
62	Locomotor ataxia.....	1	
63	Other diseases of the spinal cord.....	2	
64	Cerebral hemorrhage, apoplexy.....	3	6
65	Softening of the brain.....		1
66	Paralysis without specified cause.....	11	
68	Other forms of mental alienation.....	28	
68a	Dementia precox.....	5	
69	Epilepsy.....	17	
73A	Hysteria.....	5	
73B	Neuralgia.....	16	
73C	Neuritis.....	53	
74	Other diseases of the nervous system.....	27	1
74b	Neurasthenia.....	83	
75	Diseases of the eyes and their annexa.....	322	
75a	Follicular conjunctivitis.....	40	
75b	Trachoma.....	8	
76	Diseases of the ears.....	141	

TABLE VII.—Table showing discharges and deaths of employees in the hospitals of The Panama Canal, from all causes, for the fiscal year 1913-14—Continued.

	Diseases.	Dis- charged.	Died.
III. Diseases of the circulatory system.			
77	Pericarditis.....	1	.....
78	Acute endocarditis.....	4	1
78a	Malignant endocarditis.....	.....	1
79	Organic diseases of the heart.....	59	16
81a	Aneurism.....	2	4
81b	Arteriosclerosis.....	11	2
83	Diseases of the veins (varices, hemorrhoids, phlebitis, etc.).....	20	.....
83a	Hemorrhoids.....	118	.....
83b	Varices.....	2	.....
83c	Varicocele.....	44	.....
83d	Phlebitis.....	2	.....
84	Diseases of the lymphatic system (lymphangitis, etc.).....	41	.....
84a	Lymphadenitis (nonvenereal).....	115	1
85	Hemorrhage; other diseases of the circulatory system.....	7	.....
IV. Diseases of the respiratory system.			
86	Diseases of the nasal fossæ.....	251	.....
86a	Adenoid vegetations.....	3	.....
86b	Myiasis of nasal fossæ and sinuses.....	19	.....
87	Diseases of the larynx.....	2	1
87a	Laryngitis.....	6	.....
88	Diseases of the thyroid body.....	25	.....
89	Acute bronchitis.....	295	.....
90	Chronic bronchitis.....	28	.....
91	Bronchopneumonia.....	10	1
92A	Pneumonia (unqualified).....	2	.....
92B	Lobar pneumonia.....	155	45
93A	Pleurisy.....	203	.....
93B	Empyema.....	5	2
94	Pulmonary congestion, pulmonary apoplexy.....	1	.....
95	Gangrene of the lungs.....	4	1
96	Asthma.....	31	.....
97	Pulmonary emphysema.....	5	.....
98	Other diseases of the respiratory system (tuberculosis excepted).....	.....	1
98a	Abscess of lungs.....	3	1
98b	Hay fever.....	1	.....
V. Diseases of the digestive system.			
99	Diseases of the mouth and annexa.....	33	.....
99a	Diseases of the teeth and gums.....	21	.....
99b	Stomatitis.....	1	.....
100	Diseases of the pharynx.....	297	.....
100a	Pharyngitis.....	38	.....
100b	Follicular tonsillitis.....	90	.....
101a	Foreign body in the œsophagus.....	1	.....
102	Ulcer of the stomach.....	27	1
103	Other diseases of the stomach (cancer excepted).....	74	1
103a	Gastrectasis.....	1	.....
103b	Acute gastritis.....	26	.....
103c	Chronic gastritis.....	40	.....
103d	Acute indigestion.....	48	.....
104a	Colitis.....	2	.....
105	Diarrhea and enteritis (2 years and over).....	93	1
105a	Colitis.....	15	.....
106	Ankylostomiasis.....	64	.....
107c	Tœniasis.....	2	.....
108	Appendicitis and typhlitis.....	32	1
108a	Acute appendicitis.....	90	.....
108b	Chronic appendicitis.....	105	.....
109	Hernia, intestinal obstructions.....	9	1
109a	Inguinal hernia.....	240	.....
109b	Other hernias.....	22	.....
109c	Intestinal obstruction.....	.....	2
110	Other diseases of the intestines.....	68	1
110a	Constipation.....	116	.....
110b	Duodenal ulcer.....	4	1
113	Cirrhosis of the liver.....	15	.....
114	Biliary calculi.....	11	.....
115	Other diseases of the liver.....	22	.....
115a	Abscess of liver (unqualified).....	8	1
115b	Abscess of the liver entamoebic.....	4	5
115c	Cholecystitis.....	15	.....
117	Simple peritonitis (nonpuerperal).....	8	5
118	Other diseases of the digestive system (cancer and tuberculosis excepted).....	1	.....

TABLE VII.—Table showing discharges and deaths of employees in the hospitals of The Panama Canal, from all causes, for the fiscal year 1913-14—Continued.

	Diseases.	Dis- charged.	Dled.
<i>VI. Nonvenereal diseases of the genitourinary system and annexa.</i>			
119	Acute nephritis.....	15	.....
120	Bright's disease (chronic nephritis).....	80	25
122	Other diseases of the kidney and annexa.....	48	.....
122b	Movable kidney.....	1	.....
122c	Pyelonephrosis.....	6	.....
123	Calculi of the urinary passages.....	16	.....
124	Diseases of the bladder.....	6	.....
124a	Cystitis.....	17	.....
125	Diseases of the urethra, urinary abscess, etc.....	58	.....
125a	Stricture of the urethra, nonvenereal.....	61	.....
126a	Acute prostatitis.....	1	.....
126b	Chronic prostatitis.....	2	.....
126c	Abscess of the prostate.....	.....	2
127	Nonvenereal diseases of the male genital organs.....	81	.....
127b	Hydrocele.....	67	.....
128	Uterine hemorrhage (nonpuerperal).....	3	.....
129	Uterine tumor (noncancerous).....	1	.....
130	Other diseases of the uterus.....	7	.....
130a	Metritis.....	1	.....
131	Cysts and other tumors of the ovary.....	1	.....
132	Salpingitis and other diseases of the female genital organs.....	7	.....
133	Nonpuerperal diseases of the breast (cancer excepted).....	2	.....
<i>VII. The puerperal state.</i>			
134B	Accidents of pregnancy.....	1	.....
134Bc	Abortion.....	1	.....
136	Other accidents of labor.....	3	.....
<i>VIII. Diseases of the skin and of the cellular tissue.</i>			
143	Furuncle.....	81	.....
143a	Carbuncle.....	22	1
144	Acute abscess.....	188	.....
144a	Phlegmon and cellulitis.....	91	.....
145A	Trichophytosis.....	1	.....
145B	Scabies.....	6	.....
145E	Pemphigus contagiosus.....	2	.....
145G	Ground itch.....	2	.....
145I	Elephantiasis.....	2	.....
145K	Dhobie itch.....	29	.....
145M	Ulcer of the skin.....	82	.....
145O	Tropical ulcer.....	2	.....
145Q	Impetigo contagiosa.....	8	.....
145R	Urticaria.....	5	.....
145S	Ingrowing nail.....	39	.....
145T	Other diseases of the skin and annexa.....	101	.....
<i>IX. Diseases of the bones and of the organs of locomotion.</i>			
146	Diseases of the bones (tuberculosis excepted).....	60	.....
146a	Caries (nontuberculous).....	1	.....
146b	Mastoid abscess.....	1	.....
146c	Osteomyelitis.....	4	.....
146d	Periostitis.....	8	.....
147	Diseases of the joints (tuberculosis and rheumatism excepted).....	10	.....
147a	Ankylosis.....	3	.....
147b	Arthritis.....	37	.....
147c	Synovitis.....	8	.....
148	Amputations.....	50	.....
149	Other diseases of the organs of locomotion.....	161	.....
<i>X. Malformations.</i>			
150	Congenital malformations (stillbirth not included).....	6	.....
<i>XIII. Affections produced by external causes.</i>			
164	Poisoning by food.....	55	1
165	Other acute poisonings.....	3	.....
166	Conflagration.....	15	.....
167	Burns (conflagration excepted).....	97	.....
Traumatism:			
170	Firearms.....	14	.....
171	Cutting or piercing instruments.....	390	.....
172	Fall.....	361	10
173	Mines and quarries.....	185	1
174	Machines.....	147	2
175	Other crushings (vehicles, railroads, landslides, etc.).....	155	9
175a	Railroad traumatism.....	165	9

TABLE VII.—Table showing discharges and deaths of employees in the hospitals of The Panama Canal, from all causes, for the fiscal year 1913-14—Continued.

Diseases.		Dis- charged.	Died.
XIII. Affections produced by external causes—Continued			
175b	Dynamite traumatism.....	22	1
175c	Traumatism by landslides.....	11	.....
176	Injuries by animals.....	4	.....
179b	Heat exhaustion.....	1	.....
181	Electricity (lightning excepted).....	10	1
184	Homicide by other means.....	1	.....
185A	Fractures (cause not specified).....	253	1
185B	Dislocations.....	11	.....
185C	Sprains.....	123	.....
186	Other external violence.....	2,069	1
XIV. Ill-defined diseases.			
187	Ill-defined organic disease.....	1	.....
189Aa	Infections of undetermined origin.....	33	.....
189Ba	No disease.....	55	.....
189Bb	Feigned disease.....	2	.....
Total.....		15,376	280

TABLE VIII.—Consolidated hospital report.

Hospitals.	Re- main- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Re- main- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Ancon Hospital:												
Panama Canal employees.....	212	346	4,959	7,569	20	179	4,522	7,453	547	55	82	228
Panama Railroad employees....	10	40	394	1,013	3	33	344	959	42	6	15	55
Pay patients.....	117	72	3,585	1,468	46	157	3,390	1,277	86	35	180	71
Charity patients.....	13	28	348	363	10	93	321	271	5	23	25	4
Insane employees.....	5	33	13	24	2	2	9	20	.....	3	7	32
Insane nonemployees.....	26	262	21	194	3	51	15	127	3	40	26	238
Total.....	383	781	9,320	10,631	84	515	8,601	10,107	683	162	335	628
Colon Hospital:												
Panama Canal employees.....	46	34	602	477	2	20	552	434	94	36	.....	21
Panama Railroad employees....	17	32	162	327	.....	19	144	297	32	30	3	13
Private pay patients.....	34	59	468	551	.....	42	473	545	22	22	3	1
Republic of Panama pay patients.....	.....	12	15	95	4	19	12	68	1	19	1	1
Charity patients.....	8	20	66	178	1	18	66	166	7	13	.....	1
Total.....	105	157	1,313	1,628	8	118	1,247	1,510	156	120	7	37
Palo Seco Leper Asylum:												
Panama Canal employees.....	.....	.....	1	1	.....	.....	1	1	.....	.....	.....	.....
Republic of Panama pay patients.....	2	30	2	4	1	4	1	.....	.....	2	2	30
Charity patients.....	1	13	1	7	.....	2	.....	1	.....	2	2	15
Total.....	3	43	4	12	1	6	1	2	1	2	4	45
Taooga Sanitarium:												
Panama Canal employees.....	33	.....	890	.....	.....	.....	912	.....	11	.....	.....	.....
Pay patients.....	13	.....	623	.....	.....	.....	634	.....	2	.....	.....	.....
Total.....	46	.....	1,513	.....	.....	.....	1,546	.....	13	.....	.....	.....
Grand total:												
Panama Canal employees.....	291	380	6,452	8,047	22	199	5,986	7,888	653	91	82	249
Panama Railroad employees....	27	72	556	1,340	3	52	488	1,256	74	36	18	68
Republic of Panama pay patients.....	2	42	17	99	2	23	13	68	1	19	3	31
Other pay patients.....	164	131	4,676	2,019	50	199	4,497	1,822	110	57	183	72
Charity patients.....	22	61	415	548	11	113	387	438	12	38	27	20
Insane employees.....	5	33	13	24	2	2	9	20	.....	3	7	32
Insane nonemployees.....	26	262	21	194	3	51	15	127	3	40	26	238
Total.....	537	981	12,150	12,271	93	639	11,395	11,619	853	284	346	710

TABLE IX.—*Consolidated sick camp report.*

Stations.	Re- main- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Re- main- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Gamboa.....	1	10	21	135	...	...	21	136	1	9	...	...
Porto Bello.....	1	2	91	302	1	...	79	280	12	24	...	...
Toro Point.....	...	1	72	58	...	...	30	19	42	40	...	...
Total.....	2	13	184	495	1	...	130	435	55	73	...	...

Consolidated report of employees sick in quarters.

Stations.	Days excused for quarters.			New patients excused for quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	61	442	503	27	211	238
Ancon.....	1,416	2,048	3,464	614	475	1,089
Balboa.....	1,096	73	1,169	512	35	547
Corozal.....	1,285	49	1,334	736	30	766
Miraflores.....	25	25	50	11	4	15
Pedro Miguel.....	424	36	460	218	5	223
Paraiso.....	425	...	425	182	...	182
Culebra.....	825	1,470	2,295	310	507	817
Empire.....	2,596	889	3,485	1,104	341	1,445
Las Cascadas.....	175	68	243	95	22	117
Gamboa.....	124	172	296	59	75	134
Gorgona.....	123	93	216	75	48	123
Frijoles.....	...	21	21	...	10	10
Gatun.....	1,014	1,002	2,016	519	400	919
Cristobal.....	2,511	3,047	5,558	1,152	690	1,842
Porto Bello.....	99	...	99	56	...	56
Toro Point.....	65	69	134	47	27	74
Total.....	12,264	9,504	21,768	5,717	2,880	8,597

TABLE X.—*Consolidated hospital, sick camp, and sick-in-quarters report.*

	Re- main- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Re- main- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Hospitals.....	537	981	12,150	12,271	93	639	11,395	11,619	853	284	346	710
Sick camps.....	2	13	184	495	1	...	130	435	55	73	...	...
Total.....	539	994	12,334	12,766	94	639	11,525	12,054	908	357	346	710

	White.	Colored.	Total.
Total admissions to hospitals and sick camps.....	12,334	12,766	25,100
Number of employees sick in quarters.....	5,717	2,880	8,597
Total.....	18,051	15,646	33,697
Less number of patients transferred from sick camps to hospitals, and from hospitals to sanitarium, whose admissions are duplicated in above figures.....	908	357	1,265
Net admissions to hospitals and sick camps, and those sick in quarters....	17,143	15,289	32,432

Consolidated dispensary report.

Stations.	Employees.			Nonemployees.			Total.		
	White.	Colored.	Total.	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	1,752	14,719	16,471	.....	.....	.....	1,752	14,719	16,471
Ancon.....	6,405	22,478	28,883	3,944	4,314	8,258	10,349	26,792	37,141
Balboa.....	41,244	45,064	86,308	1,724	1,258	2,982	42,968	46,322	89,290
Corozal.....	22,528	21,759	44,287	7,041	920	7,961	29,569	22,679	52,248
Miraflores.....	3,516	5,072	8,588	56	69	125	3,572	5,141	8,713
Pedro Miguel.....	9,995	12,757	22,752	2,661	1,114	3,775	12,656	13,871	26,527
Paraiso.....	7,312	11,555	18,867	3,502	3,517	7,019	10,814	15,072	25,886
Culebra.....	11,412	19,716	31,128	4,614	6,123	10,737	16,026	25,839	41,865
Empire.....	16,314	19,299	35,613	7,155	4,911	12,066	23,469	24,210	47,679
Las Cascadas.....	1,807	1,905	3,712	1,479	1,320	2,799	3,286	3,225	6,511
Gamboa.....	2,318	5,590	7,908	1,048	1,687	2,735	3,366	7,277	10,643
Gorgona.....	816	895	1,711	101	152	253	917	1,047	1,964
Frijoles.....	45	272	317	.....	20	20	45	292	337
Gatun.....	13,321	24,995	38,316	4,894	5,687	10,581	18,215	30,682	48,897
Cristobal.....	13,946	24,791	38,737	6,526	4,071	10,597	20,472	28,862	49,334
Porto Bello.....	4,166	7,528	11,694	817	1,765	2,582	4,983	9,293	14,276
Toro Point.....	3,276	4,771	8,047	362	411	773	3,638	5,182	8,820
Margarita Point.....	578	3,513	4,091	1	.....	1	579	3,513	4,092
Total.....	160,751	246,679	407,430	45,925	37,339	83,264	206,676	284,018	490,694

TABLE XI.—Average number of employees constantly sick in hospitals, sick camps, and quarters.

	White.	Colored.	Total.
Ancon Hospital.....	197.79	386.59	584.38
Colon Hospital.....	27.22	35.94	63.16
Palo Seco Leper Asylum.....	.09	.25	.34
Taboga Sanitarium.....	14.81	.....	14.81
Total.....	239.91	422.78	662.69

	Sick camps.			Sick in quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	.....	.....	.....	0.17	1.21	1.38
Ancon.....	.....	.....	.....	3.88	5.61	9.49
Balboa.....	.....	.....	.....	3.00	.20	3.20
Corozal.....	.....	.....	.....	3.52	.13	3.65
Miraflores.....	.....	.....	.....	.07	.07	.14
Pedro Miguel.....	.....	.....	.....	1.16	.10	1.26
Paraiso.....	.....	.....	.....	1.16	.....	1.16
Culebra.....	.....	.....	.....	2.26	4.03	6.29
Empire.....	.....	.....	.....	7.11	2.44	9.55
Las Cascadas.....	.....	.....	.....	.48	.13	.66
Gamboa.....	.33	4.39	4.72	.34	.47	.81
Gorgona.....	.....	.....	.....	.34	.25	.59
Frijoles.....	.....	.....	.....	.....	.06	.06
Gatun.....	.....	.....	.....	2.78	2.74	5.52
Cristobal.....	.....	.....	.....	6.88	8.35	15.23
Porto Bello.....	1.02	3.48	4.50	.27	.....	.27
Toro Point.....	.29	.22	.51	.18	.19	.37
Total.....	1.64	8.09	9.73	33.60	26.03	59.63

Average number of employees constantly sick.

	White.	Colored.	Total.
Hospitals.....	239.91	422.78	662.69
Sick camps.....	1.64	8.09	9.73
Sick in quarters.....	33.60	26.03	59.63
Total.....	275.15	456.90	732.05

TABLE XI.—Average number of employees constantly sick in hospitals, sick camps, and quarters—Continued.

Average number of employees constantly sick per 1,000.

	White.	Colored.	Total.
Hospitals.....	25.57	9.86	12.68
Sick camps.....	.17	.19	.19
Sick in quarters.....	8.58	.61	1.14
Total.....	29.32	10.66	14.01

TABLE XII.—Average number of days' treatment per employee in hospitals, sick camps, and quarters.

Hospitals.	White.	Colored.	Total.
Ancon Hospital.....	13.15	16.20	15.02
Colon Hospital.....	12.06	15.69	13.89
Palo Seco Leper Asylum.....	31.00	92.00	61.50
Taboga Sanitarium.....	5.86	.....	5.86
Total.....	12.10	16.16	14.41

	Sick camps.			Quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	.....	.....	.....	2.26	2.09	2.11
Ancon.....	.....	.....	.....	2.31	4.31	3.18
Balboa.....	.....	.....	.....	2.14	2.09	2.14
Corozal.....	.....	.....	.....	1.75	1.63	1.74
Miraflores.....	.....	.....	.....	2.27	6.25	3.33
Pedro Miguel.....	.....	.....	.....	1.33	7.20	2.06
Paraiso.....	.....	.....	.....	2.35	.....	2.35
Culebra.....	.....	.....	.....	2.66	2.90	2.81
Empire.....	.....	.....	.....	2.35	2.61	2.41
Las Cascadas.....	.....	.....	.....	1.84	3.09	2.08
Gamboa.....	5.45	11.05	10.31	2.10	2.29	2.21
Gorgona.....	.....	.....	.....	1.64	1.94	1.76
Frijoles.....	.....	.....	.....	.....	2.10	2.10
Gatun.....	.....	.....	.....	1.95	2.51	2.19
Cristobal.....	.....	.....	.....	2.18	4.42	3.02
Porto Bello.....	4.05	4.18	4.15	1.77	.....	1.77
Toro Point.....	1.50	1.34	1.43	1.38	2.55	1.81
Total.....	3.23	5.81	5.12	2.15	3.30	2.53

TABLE XIII.—Subsistence and operating expenses.

	Hospitals.	Sick camps.	Total.
SUBSISTENCE EXPENSES.			
Number of days' rations issued to patients.....	462,146	7,403	469,549
Cost of rations issued to patients.....	\$115,503.73	\$1,312.47	\$116,816.20
Cost of subsistence per patient per day.....	\$0.249	\$0.177	\$0.248
OPERATING EXPENSES.			
Number of days' relief furnished patients.....	462,146	7,403	469,549
Cost of operation.....	\$628,658.25	\$2,816.97	\$631,475.22
Cost per capita per day.....	\$1.36	\$0.38	\$1.34
Cost of operation with amount received from outside patients, etc., deducted.....	\$421,112.04	\$2,759.87	\$423,871.91
Cost per capita per day with above deduction.....	\$0.91	\$0.37	\$0.90
Cost of dispensaries.....	\$114,700.41	.....	.....

TABLE XIV.—*Outside patients treated in hospitals, and amounts collected for their treatment.*

	Number of cases treated.	Number of days' relief.	Amount.
Patients for whom the Republic of Panama pays various prices per day.....	2,767	77,666	\$58,364.78
Patients for whom the Panama Canal pays various prices per day..	280	6,546	2,615.10
Patients from the Republic of Panama paying various prices.....	1,914	17,842	57,407.14
Patients from the Canal Zone paying various prices.....	8,214	70,580	52,677.57
Patients from the Canal Zone not paying.....	2,366	47,487	.....
Patients from the Republic of Panama not paying.....	260	2,347	.....
Total.....	15,801	222,468	171,064.59

NOTE.—Patients carried from one month to another are considered as separate cases in above table.

TABLE XV.—*Surgical operations performed in hospitals.*

	Number.	Died.		Number.	Died.
Amputations:			Genitourinary tract—Con.		
Shoulder.....	1	.....	Perineoplasty.....	39	.....
Arm.....	2	.....	Trachelorrhaphy.....	37	.....
Forearm.....	4	.....	Vaginal sections.....	1	.....
Thigh.....	6	1	Vaginal punctures.....	3	.....
Leg.....	17	2	Obstetrical:		
Foot.....	4	.....	Cesarian section, abdomi-		
Digits, multiple.....	35	.....	nal.....	13	5
Thigh, double.....	2	1	High forceps.....	3	.....
Leg, double.....	4	1	Low forceps.....	25	.....
Arm and leg.....	2	1	Perineorrhaphy.....	76	.....
Operations on bones:			Thorax:		
Craniectomy—			Thoracotomy.....	11	2
Decompressive.....	12	3	Thoracoplasty.....	2	.....
Exploratory.....	4	.....	Pneumothoracotomy.....	1	.....
Laminectomy.....	3	1	Excision of breast and		
Ostectomy.....	15	.....	axilla.....	2	.....
Excision of maxilla.....	2	1	Gunshot wound of chest,		
Resection—			operation for.....	1	.....
Elbow.....	1	1	Rectum:		
Ankle.....	2	.....	Hemorrhoids, radical cure	151	.....
Wiring fractures—			Fistula in anus, excision		
Simple.....	66	.....	of.....	15	.....
Compound.....	35	1	Prolapsus rectum, radical		
Adenectomy:			excision.....	1	.....
Cervical.....	14	.....	General:		
Axillary.....	8	.....	Thyroidectomy.....	10	.....
Inguinal—			Aneurismorrhaphy.....	1	.....
Single.....	389	.....	Varicose veins, excision of.	31	.....
Double.....	105	.....	Tenorrhaphy.....	17	.....
Femoral.....	27	.....	Excision of surface neo-		
Herniotomy:			plasms.....	62	.....
Inguinal—			Gunshot wound of soft		
Single.....	197	.....	parts, operation for.....	2	.....
Double.....	92	.....	Extensive injuries to soft		
Femoral.....	3	.....	parts, operation for.....	8	.....
Ventral.....	27	.....	Plastic operation for se-		
Combined (any two of the			vere injuries.....	14	.....
above).....	5	.....	Plastic operation for ef-		
Strangulated.....	10	2	fects of disease.....	18	.....
Genitourinary tract:			Skin graft.....	35	.....
Nephrotomy.....	3	.....	Laparotomy:		
Nephrectomy.....	3	.....	For general peritonitis....	4	2
Nephropexy.....	1	.....	For tuberculous peritoni-		
Ureterotomy.....	1	.....	tis.....	3	1
Cystotomy.....	3	.....	For intestinal obstruction.	7	4
Urethrotomy—			Exploratory.....	9	3
Internal.....	55	.....	Gastrotomy.....	1	.....
External.....	36	.....	Gastro-antrostomy.....	14	1
Prostatectomy.....	2	.....	Entero-enterostomy.....	3	1
Varicocele, radical cure...	17	.....	Enterectomy.....	3	.....
Hydrocele—			Enterorrhaphy.....	1	.....
Single, radical cure...	56	.....	Appendectomy.....	357	.....
Double, radical cure...	10	.....	Appendectomy with local		
Orchidectomy.....	10	.....	peritonitis.....	30	.....
Epididymotomy.....	107	.....	Appendectomy with gen-		
Amputation of scrotum...	43	.....	eral peritonitis.....	9	6
Curetage uteri.....	100	2	Colostomy.....	4	1

TABLE XV.—Surgical operations performed in hospitals—Continued.

	Number.	Died.		Number.	Died.
Laparotomy—Continued.			Laparotomy—Continued.		
Resection of rectum.....	1	-----	Ovarian cystectomy.....	6	-----
Cholecystotomy.....	3	-----	Oophorectomy.....	1	-----
Cholecystostomy.....	24	1	Suspensio-uteri.....	64	1
Cholecystectomy.....	5	-----	Plastic operation for		
Cholechootomy.....	1	-----	chronic pelvic peritoni-		
Abscess of liver—			tis.....	84	-----
Laparo-hepatotomy			For ectopic gestation.....	4	1
for.....	14	4	For trauma:		
Thoraco-hepatotomy			General peritonitis.....	2	2
for.....	6	2	Hematoperitoneum.....	2	1
Pan-hysterectomy.....	7	-----	Rupture of liver.....	2	-----
Supravaginal hysterec-			Gunshot wound of abdo-		
tomy.....	52	1	men.....	1	-----
Hysteromyomectomy.....	42	1	Stab wound of abdomen..	2	-----
Myomectomy.....	10	-----	Major operations, various		
Salpingectomy—			other.....	112	1
Single.....	13	-----	Minor operations, various.	2,552	1
Double.....	13	-----			
Salpingo-oophorectomy...	18	-----	Total.....	5,606	59

TABLE XVI.—Operations and work performed in eye, ear, nose, and throat clinics.

Operations.	Number.	Operations.	Number.
Abscess, parotid.....	1	Removal of:	
Adenectomy.....	191	Stone from sublingual duct.....	1
Advancement of external rectus.....	1	Nasal polyp.....	6
Bowman's dilatation of lacrimal duct...	3	Foreign body from esophagus.....	1
Canthotomy.....	1	Resection:	
Capsulectomy.....	9	External rectus.....	5
Cataract, needling.....	3	Inferior rectus.....	2
Cleft palate.....	1	Internal rectus.....	1
Corneal ulcer (cauterization).....	3	Rhino plastic.....	1
Conjunctivitis, follicular, grattage.....	1	Sclerotomy, posterior.....	1
Cysts.....	4	Septal spurs.....	3
Cyst, sebaceous, excision.....	1	Sequestrotomy.....	1
Enucleation.....	11	Sinusotomy.....	17
Evisceration.....	7	Sinusotomy, nasal.....	5
Excision of chalazion.....	9	Submucous resection of nasal septum...	255
Expression for follicular conjunctivitis..	1	Suture, lacerated sclera.....	1
Expression for trachoma.....	20	Tarsal tumors.....	3
Extraction of cataract.....	18	Tarsalectomy for trachoma.....	1
Glaucoma trephine.....	1	Tattoo, cornea.....	1
Iridectomy.....	41	Tenotomy.....	10
Iridotomy.....	1	Tonsillectomy.....	422
Lacrimal duct probed.....	1	Tracheotomy.....	2
Lingual abscess.....	1	Tucking:	
Mastoidectomy.....	17	Internal rectus.....	1
Paracentesis of cornea.....	5	External rectus.....	2
Plastic:		Turbinectomy.....	59
On ear.....	5	Various minor operations.....	868
On eyeball.....	3		
On eyelid.....	3	Total.....	2,138
On face.....	5	Refractions.....	2,193
On nose.....	6	Outside cases treated.....	16,214
Polypoid growth, tonsil removed.....	2		
Pterygium:		Grand total.....	20,545
Ablation.....	25		
Transplantation.....	68		

TABLE XVII.—Consolidated ward laboratory report of all hospitals.

Blood examinations.....	14,717	Stool examinations.....	12,705
Estivo-autumnal.....	2,903	Ascaris lumbricoides.....	552
Tertian.....	637	Uncinaria ova.....	1,871
Mixed tertian and estivo-autumnal....	54	Tricocephalus dispar.....	1,817
Quartan.....	53	Strongyloides intestinalis.....	677
Differential blood counts.....	860	Tenia.....	2
Leucocyte counts.....	2,575	Tenia saginata.....	4
Red blood counts.....	113	Ameba.....	71
White blood counts.....	57	Mucus.....	24
Hemoglobin estimations.....	1,833	Entamoeba.....	79
Filaria.....	1	Ciliated monads.....	221
Relapsing fever.....	4	Bilharzia.....	10

TABLE XVII.—*Consolidated ward laboratory report of all hospitals—Continued.*

Stool examinations—Continued.		Urine examinations—Continued.	
Pus and blood.....	1,965	Microscopical examinations.....	235
Pus and epithelial cells.....	1	Trichomonas vaginalis.....	25
Balantidium coli.....	12	Hemin crystals.....	12
Entamoeba, tetragena.....	4	Guaiac tests.....	111
Oxyuris vermicularis.....	2	Red blood cells.....	21
Entamoeba, histolytica.....	31	Pus and epithelium.....	376
Entamoeba coli.....	1	Ciliated monads.....	27
Guaiac tests.....	42	Sputum examinations.....	2,283
Bismuth crystals.....	152	Tubercle bacilli.....	438
Cercomonas, intestinalis.....	97	Ameba.....	6
Urine examinations.....	29,609	Elastic tissue.....	2
Albumen.....	9,016	Miscellaneous:	
Albumen and casts.....	6,147	Examinations of pleural effusions.....	22
Sugar.....	279	Examinations of various smears and	
Pus and blood.....	5,868	discharges.....	316
Gonococci.....	5	Examinations of spinal fluid.....	16
Indican.....	49	Examination of vaginal and urethral	
Epithelium.....	2,067	discharges.....	146
Bile.....	105	Gastric analysis.....	11

TABLE XVIII.—*Ancon Hospital.*

NATIONALITY OF PATIENTS.

Class.	Number treated.	American.		Other nations.	
		White.	Colored.	White.	Colored.
Panama Canal employees.....	13,086	2,798	26	2,218	8,044
Panama Railroad employees.....	1,457	226	2	137	1,092
Pay patients.....	5,242	2,455	2	1,115	1,670
Charity patients.....	752	274	2	74	402
Insane employees.....	75	6	.....	8	61
Insane nonemployees.....	503	11	.....	33	459
Total.....	21,115	5,770	32	3,585	11,728

Number of days' relief furnished patients, 393,705.

Cost of subsistence per patient per day, \$0.23.

TABLE XIX.—*Colon Hospital.*

NATIONALITY OF PATIENTS.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Panama Canal employees.....	1,159	451	.....	191	517
Panama Railroad employees.....	538	106	.....	55	377
Private pay.....	1,112	271	.....	210	631
Republic Panama pay.....	122	.....	.....	18	104
Charity patients.....	272	42	.....	26	204
Total.....	3,203	870	.....	500	1,833

Number of days' relief furnished patients, 40,761.

Cost of subsistence per patient per day, \$0.30.

NOTE.—Operations at Ancon and Colon Hospitals (see report of all surgical operations); laboratory reports of Ancon and Colon Hospitals (see consolidated ward laboratory report).

TABLE XX.—*Palo Seco Leper Asylum.*

NATIONALITY OF PATIENTS.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Panama Canal employees.....	2	1	.....	.....	1
Pay patients.....	38	.....	.....	2	36
Charity patients.....	22	.....	.....	2	20
Total.....	62	1	.....	4	57

Number of days' relief furnished patients..... 17,074

Cost of subsistence per patient per day..... \$0.28

TABLE XXI.—*Taboga Sanitarium.*

NATIONALITY OF PATIENTS.

Class.	Number treated.	Americans.	Other nations.
Panama Canal employees.....	923	810	113
Pay patients.....	636	600	36
Total.....	1,559	1,410	149

Number of days' relief furnished patients..... 9,009
 Cost of subsistence per patient per day..... \$0.71

NOTE.—No colored patients treated at Taboga Sanitarium.

TABLE XXII.—*Santo Tomas Hospital.*

Class.	Remain- ing July 1.	Ad- mitted.	Died.	Dis- charged.	Trans- ferred.	Remain- ing June 30.
Pay cases.....	47	1,212	42	1,173	.....	44
Charity cases.....	261	8,360	534	7,769	.....	318
Total.....	308	9,572	576	8,942	.....	362

Average number of days' treatment per patient..... 13.18
 Average number of patients constantly sick..... 343.65
 Number of days' relief furnished patients..... 125,434
 Cost of subsistence per patient per day..... \$0.24

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Pay cases.....	1,259	.....	.....	511	748
Charity cases.....	8,621	.....	.....	964	7,657
Total.....	9,880	.....	.....	1,475	8,405

Operations.

	Number.	Died.
Major.....	1,330	37
Minor.....	506	.....
Total.....	1,836	37

Dispensary.

Class.	White.	Colored.	Total.
Natives.....	664	4,005	4,669
Foreigners.....	414	1,888	2,302
Total.....	1,078	5,893	6,971

TABLE XXIII.—*Board of health laboratory.*

Bacteriological examinations:		Chemical examinations—Continued.	
Water.....	4	Gear grease.....	1
Milk.....	1	Stomach contents.....	4
Cultures, various.....	4	Organs and contents (post-mortem) for poisons.....	1
Fluids and exudates.....	1	Urine.....	37
Blood cultures.....	309	Various liquids, fluids, etc.....	112
Throat cultures (diphtheria suspects).....	466	Various metals.....	3
Cultures from autopsies.....	76	Paste.....	1
Cultures from eye.....	3	Sugar cane.....	1
Stool cultures.....	340	Oil, transformer room.....	5
Urine cultures.....	688	Brass borings.....	2
Sputum.....	1	Sugar, brown.....	1
Pus.....	19	Seeds of <i>I plant cassia occidentalis</i> L. (Coffee senna).....	1
Hydrocele fluid.....	1	Pyrene (fire extinguisher).....	2
Knee-joint fluid.....	18	Liver and urine for arsenic.....	1
Spinal fluid.....	34	Preparation of dark fluid and U-tube for testing hydroelectric plant, Gatun.....	1
Various smears and specimens.....	29	Vomitus.....	1
Pleural fluid.....	3	Ether.....	3
Plague suspect.....	1	"Pabst Extract".....	1
Fluid from chest.....	4	Whisky.....	1
Hand lesion.....	1	Phenol oil.....	1
Abdominal fluid.....	3	Test meal.....	1
Fluid from pleural cavity.....	3	Stool.....	2
Fluid from gall bladder.....	7	"Ambrew".....	1
Epithelial flakes.....	1	Larvacide to determine deterioration.....	1
Panama oysters (consignments).....	2	Agglutination reactions.....	157
Determinations:		Autopsies.....	515
Germicidal test, proprietary disinfectant.....	1	Autopsies of cows.....	1
Germicidal test, phenol oil.....	1	Bodies embalmed.....	72
Moisture and volatile matter in soil.....	6	Hydrophobia, preventive treatment.....	1
Examinations:		Pathological tissues prepared, frozen.....	46
Leper suspects.....	34	Pathological tissues prepared, paraffin.....	5,699
Animals.....	59	Surgical pathological tissues and neoplasms reported.....	323
Rats.....	2,556	Vaccinations, antipest.....	6
Chemical examinations:		Vaccine inoculations, antityphoid.....	41
Sodium phosphate.....	1	Vaccine treatment, autogenous, prepared.....	51
Alcoholic beverages.....	3	Water, sanitary analysis of.....	1
Powder.....	1	Wasserman reactions.....	3,018
Gall stones.....	2		
Kerosene.....	1		
Red lead.....	1		
Soap.....	1		
Substance from valve stem.....	1		

TABLE XXIV.—*Issues of quinine.*

Month.	Kilograms.	Pounds avoirdupois.
July.....	33.59	74.05
August.....	38.33	84.50
September.....	40.73	89.80
October.....	36.50	80.46
November.....	17.00	37.48
December.....	39.166	86.35
January.....	34.50	76.06
February.....	47.00	103.62
March.....	29.20	64.38
April.....	32.00	70.55
May.....	12.00	26.46
June.....	43.00	94.80
Total.....	403.016	888.51
Average per month.....	33.585	74.04

TABLE XXV.—*Sanitation.*

CITY OF PANAMA.

Mosquito work:	
Linear feet of ditches cleaned.....	818,547
Linear feet of ditches dug.....	1,120
Square feet of weeds and grass cut and removed.....	2,524,000
Cesspools cleaned.....	11
Wells filled.....	1
Cubic yards of earth used in filling cesspools, wells, and holes.....	7,259
Loads of grass removed and burned.....	1,443
Square yards of pools oiled.....	119,704
Water containers treated.....	226,835
Mosquito breeding places found.....	2,585
Fly breeding places found.....	2,446

Disinfection brigade:		
Houses disinfected for diphtheria.....		23
Houses disinfected for tuberculosis.....		2
Houses disinfected for chickenpox.....		14
Houses disinfected for cerebrospinal meningitis.....		5
Houses disinfected for scarlet fever.....		73
Houses disinfected for measles.....		2
Houses disinfected for smallpox.....		1
Houses disinfected for typhoid fever.....		10
Houses disinfected for simple meningitis.....		1
Number of cubic feet disinfected.....	1,356,655	
Number of rooms disinfected.....	309	
Material used:		
Crude oil.....	gallons..	1,825
Larvacide.....	do.....	5,715
Inspection of houses and yards:		
Houses and yards inspected.....		14,265
Notices served and nuisances abated.....		314
Number of letters to alcalde requesting enforcement of sanitary rules and regulations.....		24
Number of old buildings condemned.....		578
Number of yards cleaned.....		3,794
Number of buildings demolished.....		180
Loads of refuse removed from the city.....		6,766
New buildings:		
Number of plans submitted to health officer and approved.....		331
Number of permits granted for repairs to old buildings.....		680
Garbage collection:		
Number of loads of garbage removed to dump and burned.....		34,684
Total number of cans of garbage emptied (2 months).....		199,091
Street cleaning:		
Number of square yards of street cleaned daily.....		500,000
Number of square yards of streets sprinkled daily.....		96,667
Vaccinations:		
Number of persons vaccinated.....		4,844

COLON, CRISTOBAL, MOUNT HOPE, AND TORO POINT.

Water and sewers:		
Number of connections made during the year.....		88
Total number of connections made to date.....		1,148
Number of outstanding permits.....		599
Number of houses in which extensions were made.....		31
Houses:		
Plans approved.....		78
Permits to repair issued.....		643
Permits to occupy issued.....		83
Temporary permits to occupy issued.....		20
Sanitation of Colon:		
Number of loads of yard garbage removed.....		5,512
Average number of cans of garbage removed daily.....		2,180
Number of acres of vegetation removed.....		195
Number of acres of streets cleaned.....		9,006
Number of private properties cleaned.....		895
Number of square yards of pools oiled.....		217,046
Number of mosquito-breeding places destroyed.....		1,534
Number of square yards of vegetation removed.....		76,000
Number of water receptacles treated.....		322,200
Number of linear feet of ditches maintained.....		108,118
Notice to abate nuisances served.....		2,307
Number of nuisances abated.....		2,174
Number of buildings inspected.....		43,711
Number of rats killed.....		330
Number of square yards of alleys cleaned.....		5,532,374
Number of square yards of streets sprinkled.....		398,000
Number of fly-breeding places destroyed.....		1,374
Gallons of larvacide used (month of June).....		840
Number of cubic yards of ditches constructed.....		134
Colon and Cristobal garbage disposed of at dump, Colon.....		
Sanitation of Cristobal:		
Number of square yards of pools oiled.....		36,250
Number of water receptacles treated.....		47,470
Number of mosquito-breeding places destroyed.....		206
Number of mosquitoes killed in barracks.....		15,567
Number of fly-breeding places destroyed.....		193
Number of mosquitoes killed in cars.....		2,185
Number of buildings inspected.....		560
Gallons of larvacide used (month of June).....		106
Sanitation of Mount Hope:		
Number of square yards of pools oiled.....		1,061,750
Number of water receptacles treated.....		226,850
Number of linear feet of ditches maintained.....		388,020
Number of mosquito-breeding places destroyed.....		2,440
Number of linear feet of ditches constructed.....		34,049
Number of mosquitoes killed in outfit cars.....		37,642
Number of cubic yards of ditches constructed.....		525
Number of mosquitoes killed in barracks.....		102,080
Gallons of crude oil used (month of June).....		2,106
Gallons of larvacide used (month of June).....		586

Sanitation of Toro Point:

Number of square yards of pools oiled.....	65,417
Number of water receptacles treated.....	16,588
Number of mosquito-breeding places destroyed.....	58
Number of linear feet of ditches constructed.....	810
Number of linear feet of ditches maintained.....	112,468
Number of doses of quinine tonic distributed.....	38,160
Number of cubic yards of ditches constructed.....	704
Number of adult mosquitoes killed.....	5,344
Number of pit closets oiled.....	12
Number of fly-breeding places destroyed.....	3
Number of gallons of larvacide used (month of June).....	81
Number of gallons of crude oil used (month of June).....	155
Vaccinations: Number of persons vaccinated.....	1,040

CANAL ZONE.

Work requests on quartermaster's department:

Grass cutting.....	320
Screen repairing.....	232
Miscellaneous.....	374
Work requests on engineering department.....	391
Work requests on other departments.....	52
Notice served for abatement of nuisances.....	1,322
Arrests for violation of sanitary regulations.....	175
Convictions.....	165
Building permits approved.....	109
Inspections of closets.....	54,059
Inspections of stores.....	3,893
Inspections of restaurants.....	1,299
Inspections of shops.....	2,235
Garbage cans emptied.....	1,999,419
Closets disinfected.....	133,854
Houses disinfected.....	86
Houses fumigated.....	1
Rat traps used daily.....	459
Water and sewer connections made.....	24
Number of adult anopheles destroyed at houses.....	121,302
Number of adult culices destroyed at houses.....	210,903
Number of containers found with stegomyia larvae.....	894
Number of adult stegomyia destroyed in houses.....	32
Material used:	
Larvacide.....gallons.....	87,144
Crude oil.....do.....	427,506
Rats destroyed.....	10,225

TABLE XXVI.—*Quarantine service.*

PORTS OF PANAMA-BALBOA AND COLON-CRISTOBAL.

Number of vessels inspected and passed.....	1,317
Number of vessels detained in quarantine.....	130
Number of vessels fumigated on arrival.....	117
Number of vessels fumigated prior to departure.....	48
Number of pieces of baggage handled and stored.....	5,303
Number of crew inspected.....	132,107
Number of passengers inspected.....	71,743
Total number of persons inspected.....	203,850
Number of persons vaccinated at ports of arrival because of compulsory vaccination law.....	9,329
Number of persons vaccinated at ports of departure or en route because of compulsory vaccination law.....	14,656
Total number of persons vaccinated.....	23,985
Number of persons held in quarantine at the detention stations to complete period of incubation of yellow fever or plague.....	4,270
Number of persons held in quarantine on board vessels to complete period of incubation of yellow fever or plague.....	18,351
Total number of persons held in quarantine.....	22,621
Number of persons landed from foreign ports:	
Cabin.....	23,359
Steerage.....	18,413
	41,772
Number of persons embarked for foreign ports:	
Cabin.....	26,059
Steerage.....	31,780
	57,839
Apparent decrease for the year from foreign ports:	
Cabin.....	2,774
Steerage.....	13,367
	16,141
Number of persons arriving from coast towns on small craft.....	33,500
Number of persons embarked for coast towns on small craft.....	28,915
Apparent increase for the year from coast towns.....	4,585
Total number of persons landed.....	75,272
Total number of persons embarked.....	86,754
Excess over number landed.....	11,432
Plus number for Pacific ports.....	3,340

Total apparent decrease for the year.....	14,822
Number of immigrants recommended for rejection.....	33
Number of certificates issued to outgoing passengers.....	476
Number of persons refused certificates because of trachoma.....	61
Number of bills of health viséed.....	728

BOCAS DEL TORO.

Number of vessels inspected and passed.....	384
Number of crew inspected and passed.....	21,863
Number of passengers inspected and passed.....	11,273
Number of passengers, in transit, inspected and passed.....	6,054
Number of persons held to complete period of incubation of yellow fever.....	42
Number of persons held to complete period of incubation of plague.....	13

TABLE XXVII.—Personnel report.

[Average number of employees at work during the year.]

Chief health office.....	24	Dispensaries—Continued.	
Property division.....	9	Cristobal.....	6
Quarantine service.....	40	Culebra.....	5
Health office, Panama.....	138	Empire.....	6
Health office, Colon.....	125	Frijoles.....	1
Ancon Hospital.....	520	Gatun.....	7
Colon Hospital.....	84	Gorgona.....	4
Santo Tomas Hospital.....	6	Las Cascadas.....	3
Taboga Sanitarium.....	19	Margarita Point.....	1
Palo Seco Leper Asylum.....	15	Miraflores.....	3
Zone sanitation.....	166	Naos Island.....	2
Hospital farm.....	34	Paraiso.....	4
Dispensaries:		Pedro Miguel.....	4
Ancon.....	5	Porto Bello.....	3
Balboa.....	6	Toro Point.....	2
Bas Obispo.....	2		
Corozal.....	5	Total.....	1,249

TABLE XXVIII.—Hospital cases of malaria among employees.

Month.	Discharged.		Died.		Total cases.	Annual average death rate per 1,000.	Annual average number cases per 1,000.	Number of employees.
	White.	Colored.	White.	Colored.				
July.....	91	239	.....	1	331	0.21	69	57,960
August.....	109	255	1	2	367	.62	75	58,465
September.....	79	216	1	.....	296	.20	60	59,192
October.....	114	295	1	.....	410	.21	84	58,344
November.....	85	285	1	2	373	.67	83	53,942
December.....	98	236	1	1	336	.48	80	50,357
January.....	115	371	.....	.....	486	.....	118	49,328
February.....	76	207	.....	.....	283	.....	69	49,459
March.....	59	122	.....	1	182	.26	47	46,611
April.....	44	99	.....	.....	143	.....	36	47,748
May.....	56	143	.....	.....	199	.....	50	48,039
June.....	73	174	.....	.....	247	.....	62	47,579
Total.....	999	2,642	5	7	3,653	.23	70	52,252

APPENDIX I-1.

REPORT OF THE EXECUTIVE SECRETARY, EXECUTIVE DEPARTMENT.

The Governor's circular No. 660-10 describes the organization of the executive department as of June 30, 1914, and is quoted herewith.

ORGANIZATION.

1. The Executive Department embraces the general office business of the Governor, the work under the supervision of the Executive Secretary as given in the Executive Order of January 27, 1914, the Courts, and the offices of the Special Attorney, the District Attorney, and the Canal Record.

2. The following is the skeleton organization of the Executive Department:

- (a) Executive Office.
 - (1) Clerical Bureau.
 - (2) Personnel Bureau.
 - (3) Time-keeping Bureau.
 - (4) Cost-keeping Bureau.
 - (5) General Bureau.
 - (6) Bureau of Clubs and Playgrounds.
- (b) Division of Civil Affairs.
- (c) Police and Fire Division.
- (d) Division of Schools.
- (e) Division of Posts.
- (f) Courts:
 - (a) Supreme Court.
 - (b) District Court.
 - (c) Magistrates' Courts.
- (g) Special Attorney's Office.
- (h) District Attorney's Office.
- (i) The Canal Record Office.

3. The Executive Office will be in charge of the Executive Secretary assisted by the Chief Clerk. He will be charged with keeping the time of employees; maintaining files, records, and libraries of The Panama Canal; all matters relating to the personnel of employees; the supervision of clubs and playgrounds; and the general office business of the Governor, under the latter's direction.

4. The Division of Civil Affairs is under the direction of a Chief of Division who is charged with customs inspection for the Canal Zone, and the issuance of all licenses except those issued for the Board of Local Inspectors by the Superintendent of Transportation. The Chief of Division is also Administrator of Estates of deceased and insane employees and Shipping Commissioner for the Canal Zone.

5. The Police and Fire Division is under the direction of a Chief, who is charged with the maintenance of the peace and order required by the laws of the Canal Zone, the protection of life and property, and the proper care and custody of prisoners and convicts. He is Coroner of the Canal Zone and Warden of the Penitentiary. He is charged with the duty of protecting from fire both Government and private property.

6. The Division of Schools is under the direction of a Superintendent of Schools, who, under the supervision of the Executive Secretary, shall select and assign the force of teachers, govern the schools, prescribe the courses of instruction, and administer the affairs of the Division.

7. The Division of Posts is under the direction of a Director of Posts, who shall administer the affairs of the Canal Zone postal system, and transact business between that system and other postal systems.

8. The Courts of the Canal Zone, consisting of a Supreme Court, which will cease to exist after the completion of the business now pending, a District Court and two Magistrates' Courts, are charged with the adjudication of civil and criminal cases as provided by the laws prescribing the duties and limitations of the Courts. The expenditures for the Courts, except as fixed by law, shall be made by the Executive Secretary, and the Courts shall furnish to him such reports, statistics or other data as

may be required. The organizations of the Courts are extra-departmental and are embodied herein only to indicate the method adopted for taking care of the material business needs of the Courts.

9. The Special Attorney's Office is under the supervision and direction of the Special Attorney, reporting to the Governor. He is charged with the purchase, under the Governor's direction, of the land within the Canal Zone necessary for the construction, maintenance, operation, sanitation, or protection of The Panama Canal, and shall represent the Government before the Joint Land Commission or other Courts of tribunal in the settlement of land or property claims or claims against the Government for damage to or destruction of private property. He is also charged with the duty of codifying the various laws, executive orders, and ordinances in effect for the Canal Zone.

10. The District Attorney's Office is under the supervision and direction of the District Attorney, who shall conduct all business, civil and criminal, for the Government, except that assigned to the Special Attorney, and shall advise the Governor on legal questions touching the operation of the Canal and the administration of civil affairs.

11. The Canal Record Office is under the direction of a Special Secretary, who shall edit and publish The Canal Record and perform such other duties as may be assigned to him by the Governor.

This report embraces the following divisions of the executive department: The executive office, division of civil affairs, division of posts, police and fire division, division of schools, and the Canal Zone courts, the latter being included for administrative purposes only. All of the functions of civil government now assigned to the above-named divisions were, prior to April 1, 1914, under the direction of the department of civil administration, which ceased to exist with the abolition of the Isthmian Canal Commission as of that date, pursuant to the provisions of the Executive order of January 27, 1914. The department of civil administration, at the beginning of the fiscal year for which this report is rendered, also embraced a division of public works, which, under date of July 16, 1913, was merged with the division of municipal engineering, with the exception of the public markets and slaughterhouses, the operation and supervision of which were placed under the division of police and prisons. The office of the treasurer of the Canal Zone and the board of local inspectors, which, until April 1, 1914, were a part of the department of civil administration, were transferred, respectively, to the accounting department and to the department of operation and maintenance. Reports of the business transacted by the two last-named divisions for the entire fiscal year will be made by the heads of the respective departments of which they now constitute a part.

The principal changes made in the organization of the divisions composing the former department of civil administration were the transfer from the division of posts, customs, and revenues to the newly-created division of civil affairs of all functions relating to the issuance of licenses, the placing of postal affairs in charge of an acting director of posts, and the consolidation of the division of fire protection with the division of police and prisons under the new designation of police and fire division.

The changes mentioned, as well as the business transacted during the year by the various divisions named, are more fully described in the text of this report covering each division.

EXECUTIVE OFFICE.

The executive office is the general business office of the Governor of The Panama Canal, and is in charge of the executive secretary, whose powers and duties are defined by the Executive order of Jan-

uary 27, 1914. The executive office is divided into the following bureaus: Clerical bureau, personnel bureau, time-keeping bureau, cost-keeping bureau, general bureau, and bureau of clubs and playgrounds.

CLERICAL BUREAU.

The clerical bureau of the executive office is charged with the general correspondence for the Governor and the executive secretary, as well as the preparation of correspondence for other heads of departments and divisions. This bureau also has charge of the records of The Panama Canal, which are being gradually brought together and consolidated under one general system of files and libraries. It also has charge of miscellaneous clerical work, such as the preparation of cablegrams, the sending of telegrams, preparation of requisitions for supplies for the executive department, and other miscellaneous duties.

PERSONNEL BUREAU.

This bureau keeps proper records of all matters affecting the personnel of The Panama Canal and of the forces of the Panama Railroad Co. in the commissary department, such as changes of rates of pay, new employments, leaves of absence, changes in organization, etc. A record of each transaction, in detail, respecting each and every gold-roll employee of the canal is maintained by this bureau. This bureau also has charge of the issuing of all authorities for special rates for steamship transportation.

TIME-KEEPING BUREAU.

During this fiscal year the time-keeping work has been gradually centralized until at the close of the year the time-keeping of all departments and divisions, with the exception of the Panama Railroad Co., was being performed by the time-keeping bureau. This work included the entering of time on the time rolls, the preparation of pay rolls and pay receipts, the issuing of coupon books, and the keeping of proper statistics and records of the work performed.

COST-KEEPING BUREAU.

The report of the cost-keeping accountant, who reports direct to the Governor, will be published as a separate appendix to the Governor's annual report.

BUREAU OF CLUBS AND PLAYGROUNDS.

The following is the report of the division of clubhouses from July 1, 1913, to March 31, 1914, and the bureau of clubs and playgrounds from April 1, 1914, to June 30, 1914, as conducted under the supervision of secretaries furnished by the Young Men's Christian Association.

Changes in buildings.—The Gorgona clubhouse was closed on August 1, 1913, and was removed to Pedro Miguel, where it was reerected and opened January 27, 1914.

The Porto Bello clubhouse was closed May 1, 1914, and is now being reerected with improvements as a clubhouse for colored men at La Boca.

The Empire clubhouse, which is about to close, will be moved to Balboa, where it will be reerected and enlarged. Pending the opening of the big clubhouse, temporary quarters are now being occupied, where there are in operation four pool and billiard tables, refreshment parlors, reading and writing rooms, a barber shop, a pressing club, and a hall for occasional entertainments.

During the past year, work has been carried on throughout the entire year at Cristobal, Gatun, Empire, Culebra, and Corozal; and at Porto Bello, Pedro Miguel, Balboa, and Gorgona for a portion of the year.

During the coming year work will be conducted for the full year at six points: Cristobal, Gatun, Pedro Miguel, Corozal, and Balboa, and at La Boca for colored men.

New activities.—It has been decided to inaugurate a system of playgrounds in the permanent towns of the Canal Zone and the installation of equipment and supervision of same will be under the jurisdiction of this bureau. It is planned to have playground equipment of all kinds from sand boxes and scups for children, to tennis courts and baseball diamonds for adults. Two tennis courts are now nearing completion and work on the balance of the equipment will be started at the beginning of the next dry season.

With the cooperation of the division of schools a league has been formed to encourage interest in athletics among the school children. This league has been designated the Public School Athletic League of the Canal Zone. The first athletic meet under the auspices of this organization was in the nature of a telephone meet, held simultaneously in the clubhouses at Balboa, Corozal, Empire, Gatun, and Cristobal.

Arrangements have been made whereby special membership rates have been accorded members of the Tenth Infantry on special guard duty at Gatun and Pedro Miguel. A membership rate of 50 cents per month has been approved for these men and at certain times in the day when the regular Canal Zone employees are at work the soldiers are allowed free pool and bowling; at other hours they pay the regular rate. That this special arrangement is appreciated is shown by the fact that practically all the soldiers stationed at these points have joined the Y. M. C. A.

Membership.—The following table shows the membership for the years given:

	1913-14	1912-13	1911-12
Total membership at end of fiscal year.....	1,743	1,943	2,092
Average monthly membership.....	1,736	2,023	1,944
Largest membership any given month.....	1,885	2,127	2,092
Average percentage of members according to available gold population of clubhouse towns per cent..	51	58	58

The membership has naturally decreased owing to the abandonment of the towns of Gorgona, Porto Bello, and Empire. When the remodeled clubhouse is ready for occupancy at Balboa, it is expected that the total membership of the Zone will again cross the 2,000 mark. At present we have very limited quarters at Balboa and can scarcely accommodate the membership of 145.

The largest monthly membership throughout the year was maintained at Corozal, where, in spite of cramped quarters, the monthly average was 399.

Entertainments.—The following table gives the statistics on entertainments for the years indicated:

	1913-14	1912-13	1911-12
Companies engaged from the United States.....	6	5	7
Number of entertainments given.....	83	79	85
Total attendance.....	27,473	20,956	20,865
Local entertainments and moving pictures.....	522	475	406
Total attendance.....	97,092	111,562	96,072

The entertainment feature has continued to be predominant in Y. M. C. A. work on the Isthmus.

Talking moving pictures were shown in our clubhouses for the first time in South America and attracted the largest audiences in the history of clubhouse work. At Cristobal, Empire, and Corozal it was necessary to give two performances on the same evening in order to accommodate the public.

The entertainers secured from the United States were Miss Gay Zenola MacLaren, The Ernest Gamble Concert Co., Walter Eccles and the Four College Girls, Dr. Frederic Poole, lecturer, the Pennsylvania State College Male Quartet, and the Linton Talking Moving Picture Co. Capt. Thorwald Nilsen, of the *Fram*, was induced to give some talks during his stay, which were very highly appreciated.

Regular motion-picture exhibitions were given each week besides many special exhibitions of feature reels. Each clubhouse is now supplied with its own motion-picture machine and equipment, and there is one extra machine for emergency.

Several smokers were given in all the clubhouses.

During the year an all-Isthmian vaudeville company was organized among the amateurs on the Zone and gave performances in all the clubhouses.

A notable departure from the usual line of entertainment was the circus given under the direction of the Cristobal clubhouse on Pier 9, which was attended by about 1,500 people. The performers were all amateurs and mainly Cristobal residents. This entertainment would have been given along the line could available buildings have been found in which to hold it.

Physical work and athletics.—During the year just ended there has been more activity in this line than in several years past.

A running tract and athletic field were installed adjacent to the Corozal clubhouse, and an aquatic meet was held at Corozal on Labor Day with an attendance of over 1,000. The aquatic events were held in the east forebay of the Miraflores Locks.

An aquatic "invitation" meet was held by the Gatun Association in the canal on Thanksgiving Day, at which there was a large attendance in spite of rain that fell throughout the day.

An aquatic meet was held at Pier 9, Cristobal, under the auspices of the Cristobal Y. M. C. A. on Washington's Birthday, and there was an attendance of about 1,500.

Several local indoor contests have been held, and on June 12 the first meet of the Public School Athletic League of the Canal Zone was

held simultaneously in five clubhouses, with 211 individual entries and a total audience of about 1,500. In the coming dry season an outdoor meet will be held by this league.

At Cristobal the physical director has inaugurated classes for women and girls on the regular afternoons assigned to ladies, and the move has apparently been a beneficial one and has not interfered with the privileges enjoyed by the men. This plan has been experimented with in a small degree at other clubhouses.

Systematic exercise classes for men have been kept up, with a surprisingly good attendance considering the tropical climate.

Religious work.—Song services and similar meetings have been held at the clubhouses at hours that did not conflict with the regular church services. There was an average attendance of 83 at 156 religious meetings held during the year. Several Bible clubs were organized, and in some of the towns where there are no chapels Sunday schools are held in the building. At Culebra travel lectures illustrated by excellent stereopticon slides were given on Sunday nights, the subjects varying from points of interest in our own country to scenes in the Holy Land and other foreign countries.

Educational work.—Spanish classes continued in popularity in all the clubhouses, with monthly registrations that have varied from 6 or 8 in the small classes to 45 in the large classes.

Classes in vocal and instrumental music have flourished at Gatun and an excellent glee club was for a time conducted by the secretary.

Boys' work.—Special privileges were continued for boy members between the ages of 10 and 16 years and when the playground equipment previously mentioned in this report is installed the effectiveness of the efforts for the boys will be greatly increased.

There have been interclubhouse games and tournaments between the boys and excursions have been taken through the Culebra Cut, to Cano Saddle, to old Panama and various other places. Special gymnasium classes are held for boys three times a week. "Father and son" banquets were held at Pedro Miguel and Cristobal and were undoubtedly of great help to the boys who attended.

Finances.—The financial management of the clubhouses continued in the hands of an advisory committee until March 31 and the general supervision of each clubhouse is in the hands of an executive council composed of residents of the town and appointed by the international committee.

Herewith is a statement of net receipts and expenditures paid from Y. M. C. A. funds:

Balance on hand July 1, 1913.....	\$27, 349. 78
Net receipts:	
Membership.....	\$15, 956. 32
Soda fountain.....	6, 838. 71
Billiards and pool.....	2, 706. 43
Salable merchandise.....	406. 07
Instructions.....	72. 75
Pressing club.....	78. 72
	26, 059. 00
	53, 408. 78
Net expense:	
Barber shop.....	209. 43
Bowling alleys.....	1, 220. 34
Entertainments and motion pictures.....	10, 566. 84

Net expenses—Continued.

Library books, etc.....	\$2, 108. 14	
Office help.....	5, 656. 39	
Tournaments.....	595. 00	
Maintenance and general expense.....	1, 818. 01	
Gymnasium expense.....	317. 53	
Equipment.....	4, 030. 22	
		\$26, 521. 90
Balance on hand June 30, 1914.....		26, 886. 88
Bills payable June 30, 1914.....		8, 500. 00

The total expense paid by the Government for salaries of secretaries and janitors, upkeep of buildings, printing, etc., is \$47,869.18 as compared with \$49,925.96 last year.

SPECIAL ATTORNEY'S OFFICE.

The report of the special attorney, who reports direct to the Governor, will be published as a separate appendix to the Governor's annual report.

DIVISION OF CIVIL AFFAIRS.

The division of civil affairs was created by the order of the executive secretary, approved by the Governor, dated April 1, 1914, and is in charge of a chief of division, who acts as administrator of estates and shipping commissioner. The division is charged with the conduct of all matters relating to the customs service, the administration of estates of deceased and insane employees, and to the issue of all licenses, except those issued by the board of local inspectors. On June 30, 1914, the organization of this division consisted of 1 chief of division, 12 clerks, 1 translator, 1 storekeeper, 7 inspectors of customs, and 3 messengers.

LICENSES AND TAXES.

This division has continued the work of issuing licenses which, prior to April 1, 1914, was performed in the division of posts, customs, and revenues, except the making of collections and the issue of chauffeurs' and navigators' licenses, turned over to the board of local inspectors.

In order to facilitate the depopulation of the Canal Zone, 69 persons holding licenses in the towns of Empire, Culebra, and Golden Green were advised that no further licenses for the sale of merchandise and the maintenance of restaurants would be issued to them from and after July 1, 1914.

A complete statement of the licenses issued and taxes collected during the fiscal year will be found included in the report of Canal Zone revenues, printed as an appendix to the auditor's report.

CUSTOMS SERVICE.

During the year 280 vessels entered the port of Balboa of a total tonnage of 569,681 and 277 vessels cleared of a total tonnage of 558,334. At Cristobal 295 vessels entered of a tonnage of 832,579 and 296 vessels cleared of a tonnage of 838,708.

The usual customs services were rendered seamen and vessels, and the interests of Panama were guarded by customs inspectors on

the wharves who prevented smuggling and the entrance of dutiable articles until the proper duties had been paid to the Panaman authorities.

At the port of Balboa there arrived, in transit to the Republic of Panama or other countries, 274 aliens whose entry is prohibited under the exclusion laws. Of this number, 144 were allowed to disembark by authority of the Secretary of Foreign Affairs of the Republic of Panama, and 130 were either transferred to other vessels or returned to the port of embarkation.

ADMINISTRATION OF ESTATES.

By the terms of the Executive order of January 27, 1914, the executive secretary was placed in charge of the administration of estates, effective on April 1, 1914, and he appointed the chief of the division of civil affairs as administrator of estates.

During the year 452 estates of deceased and insane employees of The Panama Canal and the Panama Railroad Co. were administered, and there were 20 estates in the course of settlement on June 30, 1914.

Of the 452 estates of deceased and insane employees settled during the year, 323 estates were settled with the consular representatives in Panama of the countries of which deceased was a citizen or subject; 126 estates were settled direct with the heirs, upon satisfactory evidence of heirship being furnished; 2 estates were repaid to persons who had recovered their sanity; and 1 estate was divided pro rata among claimants.

The amount involved in the settlement of the 452 estates was \$36,025.95, of which \$35,357.45 belonged to the estates of deceased employees and \$668.50 to the estates of insane employees.

On June 30, 1914, there were 20 estates remaining unsettled, and 31 additional cases were being investigated from which no property or money had yet been received.

Ten estates were escheated during the year to the Government of the Canal Zone; the amount involved was \$120.59.

DIVISION OF POSTS.

At the close of the fiscal year there were 13 post offices in operation, 6 of the 17 offices in existence at the close of the fiscal year 1913 having been discontinued, while 2 new offices were established.

The sale of postage stamps and postal cards, including the revenue derived from the sale of stamp books, amounted to \$90,590.63, as compared with \$100,485.54 for the year ended June 30, 1913, and \$463.67 was collected for second-class mail matter, as compared with \$318.84 for the preceding year. The total revenue from postal sales was \$91,064.30, as compared with \$100,804.38 for the preceding fiscal year. Postage-due stamps were first placed on sale in March, 1914, and up to the end of the fiscal year the revenue derived amounted to \$2,863.92.

During the year there were manufactured in the office of the director of posts 47,250 stamp books, containing 12 and 24 two-cent stamps, and 24 one-cent stamps. These books were manufactured, including the cost of printing, for less than one-third of a cent each, and are sold for 1 cent more than the face value of the stamps contained in each. Of the total number of books made up, 43,996 were

actually sold, producing a revenue of \$439.96, less \$146.65, the estimated cost of manufacture, or a net revenue of \$293.31.

There were 198,828 money orders issued during the year, amounting to \$4,029,364.83, the fees from which amounted to \$19,408.11. The average amount of each order issued was \$20.76. Compared with the preceding fiscal year, there was a decrease of 39,488 in the number of orders issued, a decrease of \$854,259.30 in the amount, and a decrease of \$3,938.71 in fees collected. This decrease was due in part to the increased postal savings business. There were paid and repaid in the Canal Zone offices money orders amounting to \$864,993.58, as compared with \$967,223.56 paid and repaid during the year which ended June 30, 1913.

There were 5,113 postal savings accounts opened during the year, 2,180 of which were active at its close with deposits aggregating \$498,481. The average amount of each account remaining open was \$229. The 2,180 depositors included citizens or subjects of 51 different nations and dependencies. The total amount of deposits for the year was \$1,708,530, as compared with \$1,601,616 for the previous year, and the total withdrawals were \$1,855,739, as compared with \$1,312,873 for the previous year. In addition to the postal savings accounts, there was also on deposit \$70,750.41 on July 1, 1914, in the form of money orders issued and drawn on Canal Zone post offices payable to the remitter, making a total of \$569,231.41. This amount belongs almost exclusively to employees of The Panama Canal and the Panama Railroad Co.

In the registry divisions of the post offices 141,089 parcels and letters were handled. Of this number, 18,703 were domestic letters, 3,734 domestic parcels, 42,861 foreign letters, 2,219 foreign parcels, 71,347 official letters and parcels registered free, and 2,225 letters and parcels reregistered free. Compared with the preceding fiscal year, there was a decrease of 19,653 registered letters and parcels handled. Ancon and Cristobal as exchange offices handled 61,687 registers. Of these, 3,435 passed through the Ancon post office to and from Panama and Central and South American points and 58,252 through the Cristobal post office to and from the United States and foreign countries.

The Cristobal exchange office made 1,980 dispatches of mail, of which 164 dispatches were for the United States and 1,816 for all other places.

There were delivered during the year at all post offices 7,613 insured parcel-post packages. The amount of duty paid to the Republic of Panama on account of articles imported through the post offices by nonemployees and on prohibited articles imported by employees was \$8,751.33, as compared with \$4,248.48 for the preceding fiscal year.

In the office of the director of posts the usual amount of correspondence necessary in the direction of the Canal Zone postal business was handled. This consists largely of correspondence with foreign postal administrations on money-order and registry matters, the issuance of duplicate money orders and postal savings certificates in place of those of Canal Zone origin either lost, stolen, or destroyed, the return to countries of origin of unclaimed ordinary mail matter, the advertising and delivery of insufficiently directed letters, and the investigation of violations of the Postal Laws and Regulations.

DIVISION OF SCHOOLS.

The organization of this division at the end of the school year consisted of 1 superintendent, 1 supervisor of upper grades and high schools, 1 supervisor of primary grades, 2 clerks, 66 teachers (43 in the white schools and 23 in the colored schools), 2 break attendants, and 1 children's attendant, a total of 74. On June 30, 1914, the two positions of supervisor were abolished.

The schools opened on October 1, 1913, with an enrollment in that month of 2,167 children, 1,109 in the white schools and 1,058 in the colored schools, as compared with 1,157 in the white schools and 1,042 in the colored schools, a total of 2,199, during the month of October, 1912. The total enrollment during the year was 1,270 in the white schools and 1,492 in the colored schools.

Twenty-three buildings were used for school purposes during the year, including a room in the hotel building at Las Cascadas for first and second grade white children, and the church building at the same place for third and fourth grade white children; an apartment in non-housekeeping quarters at Porto Bello for white children, grades one to seven; the native church at Marajal for native children at that place, and two rooms over the hotel building at Ancon for sixth, seventh, and eighth grade white children.

No new school buildings were constructed during the year, although one building was removed and reerected and several rooms added to existing buildings. At Corozal an upper story was added to the old building for white children, the lower story divided into two rooms, and the new portion of the white school building formerly at Gorgona connected, thus providing a five-room school building for white children of all grades. The one-room colored school building at Pedro Miguel was reerected at Paraiso for use of colored children. On account of the large number of pupils transferred, it was found necessary to reopen the old building at that place. Two rooms were fitted up in the hotel building at Ancon and a branch school for sixth, seventh, and eighth grade white pupils opened in them.

In addition to the white schools at Gorgona and Toro Point, and the colored schools at Gorgona and Matachin, reported closed permanently in the report for the fiscal year 1912-13, the white school at Bas Obispo and the colored schools at Miraflores, Pedro Miguel, and Cruces were not reopened, and the following schools were permanently closed during the year: The Mandingo colored school on December 19, 1913, the Marajal colored school on February 6, 1914; the branch high school at Empire on February 20, 1914; the white school at Porto Bello on April 24, 1914; and the colored school at Cucaracha on May 29, 1914. On December 19, 1913, the white schools in the hotel building and in the church building at Las Cascadas were closed, and the first, second, and third grade children transferred to the building formerly used as a school, which had been turned over to the quartermaster's department in 1910, while the fourth and fifth grade children were transferred to the Empire school. On February 2, 1914, the third, fourth, and fifth grade room of the Culebra white school was closed, the third-grade children being transferred to the first and second grade room, while the fourth and fifth grade pupils were transferred to the Empire school. On March 16, 1914, the eighth-grade pupils at the Pedro Miguel school were transferred to the Corozal school.

During the year the sum of \$1,089 was collected for tuition from nonresidents of the Canal Zone, as compared with \$744 collected during the year which ended June 30, 1913.

Medical inspection of the white schools was continued during the year. Of the 894 pupils examined by district physicians, 352 were found defective. No complete record was kept of pupils of the Cristobal school examined at Colon hospital.

Fire drills were inaugurated during the year. Hand chemical extinguishers were installed in all the schools, and the teachers and janitors were instructed in their use.

The colored school garden at Empire was turned over to the Quartermaster's Department at the beginning of the school year, and no school gardens are now operated.

During the year a public-school athletic league was formed in the white schools. An annual meet of the league was held on June 12, 1914, in the Canal Zone clubhouses at Balboa, Corozal, Empire, Gatun, and Cristobal. There were 198 participants, 99 boys and 99 girls.

The high school as organized at the close of the year consisted of the main high school at Ancon and the branch high school for first and second year pupils at Gatun. There were nine pupils in the graduating class.

POLICE AND FIRE DIVISION.

The division of police and prisons and the division of fire protection were consolidated on April 15, 1914, under the new designation of police and fire division. The positions of assistant chief of police, fire chief, and assistant fire chief were abolished, and the position of fire inspector created.

POLICE AND PRISONS.

On June 30, 1914, the authorized force of the division was 1 chief, 1 inspector, 3 lieutenants, 8 sergeants, 15 corporals, 104 first-class white police officers, 68 colored policemen, 4 launch engineers, 6 clerks, and 1 messenger, a total of 211. The actual force, however, on June 30, 1914, totaled 202. On June 30, 1913, the actual strength was 234.

During the year 43 white and 16 colored police officers were appointed, and 57 white and 35 colored officers left the service. A reduction in the force of colored policemen was made possible on August 1, 1913, by the Panama Railroad Co. taking over the watchman service at Balboa, which up to that time was furnished by this division. On March 1, 1914, however, this division again took over the work at Balboa, at the request of the railroad company, but the officers assigned for this duty were drawn from other stations, whose strength was thus decreased. The colored policemen detailed for duty at the canal locks were withdrawn on March 1, 1914, and were replaced by white first-class policemen. The causes leading to the reduction in the force of white first-class policemen were due mainly to the closing of the substations at Empire and Cristobal districts by the elimination of towns in those districts.

The station at Gorgona and the substation at Matachin were closed on July 17, 1913, and these towns were designated as call stations with police protection furnished from the Bas Obispo station. On August 31, 1913, the call station at Matachin was abolished, and on December 15, 1913, the station at Bas Obispo was abolished. On

July 18, 1913, the call station at Cucaracha was abolished; on September 14, 1913, the station at Miraflores was abolished; likewise the station at Las Cascadas on December 15, 1913, the necessary police protection being furnished from the Empire station; that at Mount Hope on April 15, 1914; that at Paraiso on April 15, 1914; that at Porto Bello on May 13, 1914, where a caretaker invested with police powers was appointed to protect the Government's interests, and the station at Toro Point on June 1, 1914.

Four thousand nine hundred and eleven arrests were made during the year, 4,455 of which were of males and 456 of females, as compared with 6,079 males and 748 females, a total of 6,827 arrests for the previous year, a decrease of 1,916. There were 5,021 charges made against the persons arrested, of which 4,713 were for misdemeanors and 308 for felonies. Of the total number of persons arrested, 3,927 or 79.92 per cent were convicted.

Five homicides were committed during the year. In these cases 1 assailant, unknown, escaped. Of the 4 apprehended, 1 was found not guilty and discharged; the case against 1 was nolle prossed on the ground that the injuries which caused the death were inflicted in self-defense; 1 was found guilty of assault and battery and sentenced to serve 30 days in jail; and 1 was tried for involuntary manslaughter and found not guilty. This latter, a midwife, who cut off two supernumerary digits from the hands of a 1-day old baby, which died in a few minutes after the cutting as a result of hemorrhage by amputation, was rearrested on a charge of practicing surgery without a license and sentenced to serve 30 days in jail and pay a fine of \$25.

In addition to the foregoing homicide cases, 4 deaths occurred under circumstances which required police investigation.

Four persons committed suicide during the year, 2 by shooting, 1 by hanging, and 1 by taking carbolic acid.

A continuous patrol of the harbors of Ancon and Cristobal was maintained throughout the year, and numerous prosecutions for violations of navigation laws have resulted. Patrols of all the territory reserved for watershed purposes were also maintained, as well as the patrol of Gatun Lake, the latter to prevent the return of persons whose claims for the destruction of their property have been settled.

The destruction of property of persons whose claims have been settled was continued, and since the time the authority was issued to destroy abandoned houses, 2,852 of such houses have been destroyed.

During the year 190 animals were impounded, and \$288.75 was collected for pound fees and maintenance charges.

There were 75 convicts confined in the penitentiary on June 30, 1914, as compared with 133 on June 30, 1913. All convicts, with the exception of a sufficient detail to do the necessary work at the penitentiary, were employed continuously on the construction of the Empire-Gamboa road. The value of the labor performed by the convicts, on the basis of 10 cents an hour for each convict, was \$21,615.45, and the cost of their subsistence, guarding, and clothing amounted to \$26,893.04. Included in this amount is \$9,811.99, representing the increased cost of guarding on account of the work on public improvements.

In order to provide some form of diversion and amusement for the inmates of the penitentiary, weekly elemental educational classes were formed, band concerts and addresses by prominent persons and officials inaugurated when practicable, and a series of moving picture shows commenced. There is also a library of 1,500 volumes available for the use of the prisoners.

One hundred and sixty-seven cases were investigated by the chief of police, or other members of the force, acting as coroner or deputy coroners. Of these, 50 were due to accidental drowning, 45 to railroad accidents, and 43 to accidental traumatism in construction work. Investigations by this division were also conducted in 450 cases of personal injuries involving 307 employees of The Panama Canal, 51 employees of the Panama Railroad, and 71 nonemployees, of whom 4 were employees of a canal contractor.

The annual course of target practice was held. The schedule was practically the same as in previous years. Three medals of original design were awarded.

The operation and supervision of the public markets of the Canal Zone and the slaughterhouse was turned over to this division, effective on July 16 1913. In the slaughterhouse at Empire 1,533 animals were killed during the year, and the revenue derived therefrom was \$5,065. The rentals derived from the stalls and tables in the public markets amounted to \$2,599.75. On June 30, 1914, there were 5 public markets in operation, 3 having been discontinued during the year.

FIRE PROTECTION.

On June 30, 1914, the authorized force of this division was 1 inspector, 4 captains, 6 lieutenants, 33 firemen, 1 motor engineer, 1 steam fire engineer, 1 electrician, and 1 lineman, a total of 48. The actual strength of the division on June 30, 1914, was 44. This represents a reduction of 13 men in the number in service on July 1, 1913, namely, 1 chief, 1 assistant chief, 2 captains, 7 firemen, 1 clerk and 1 messenger. This reduction was made possible by the consolidation with the division of police and by the removal of fire stations located in villages where canal work has been completed.

In September, 1913, the fire station, together with the equipment at Gorgona, was removed to Corozal, and the one-man volunteer fire station at Corozal discontinued. The Las Cascadas station was closed on April 30, 1914, and the apparatus and equipment desired by the military authorities at that place transferred to them. Until August 20, 1913, fire protection was furnished at Bas Obispo by volunteers, and at Porto Bello until May 6, 1914, after which dates all fire equipment was withdrawn from those places.

No new fire stations were constructed during the year, nor was any new apparatus purchased. In October, 1913, the station at Pedro Miguel was removed to a new location, a cement floor placed under it, and the building painted and repaired. A box car was converted into temporary quarters for 2 paid firemen at Balboa and was occupied in February, 1914. Recommendations were made and plans approved for a permanent fire station at Balboa. This new station will be constructed of concrete blocks and will be provided with three doors for apparatus on the first floor with quarters and recreation rooms for the firemen on the second floor.

During the year 7,500 feet of new 2½-inch single-jacket fire hose and 1,500 feet of double-jacket fire hose was received.

The fire pump and turret nozzle which were removed from the tug *Bolivar* during the preceding year were installed on *Clapet No. 7* in August, 1913, to provide water-front and harbor fire protection at Balboa.

Fire protection was provided for the new piers Nos. 8 and 9 at Cristobal. This included a 6-inch water main on the piers, with ample supply mains and standpipes. Twenty-four hundred feet of hose were installed in racks beside the standpipes, and 3 fire-alarm boxes provided. New installations of fire hose, fire extinguishers, nozzles, etc., were made at the Balboa shops and at Gamboa, Darien, Coco Solo, and Mindi Island. Ramps for loading and unloading the automobile fire engines on flat cars were constructed at Balboa and at Cristobal.

At the close of the year there were in use 51,991 feet of 2½-inch rubber-lined hose, 288 nozzles, 19 hose reels, and 22 hose carts. The apparatus of the division consisted of 2 automobile combination fire engine and hose wagons, 2 hand hose reels, 1 combination hose and chemical wagon (in reserve), 6 hose wagons (1 in reserve), 1 steam fire engine, and 1 hook-and-ladder truck (not in service). Twelve horses are used, 10 for the 5 hose wagons and 2 for the steam fire engine.

There were 1,471 fire extinguishers under the care of the division on June 30, 1914. During the year 25,483 inspections and 624 recharges of chemical extinguishers were made, and 631 extinguishers were painted or repaired.

The inspection of the five fire-alarm systems, buildings, and fire-fighting apparatus throughout the Zone and in the buildings of the United States and the Panama Railroad Company in the cities of Colon and Panama, and on Naos, Culebra, and Tobago Islands, at the Palo Seco Leper Asylum, and at Porto Bello was maintained.

The number of volunteer fire companies on June 30, 1914, was 12, with a total membership of 188. During the preceding fiscal year there were 15 volunteer companies, with a membership of 252.

Two hundred and fifteen alarms of fire were responded to during the year, 8 of which were false alarms. Of the 207 actual fires, 98 occurred in the property of The Panama Canal, 14 in Panama Railroad property, 27 in private property, and 68 in grass, rubbish, dumps, etc., in the Canal Zone. Of the fires in private property, 11 occurred in the city of Colon, 1 in the city of Panama, 1 at Old Porto Bello in the Republic of Panama, and 14 in the Canal Zone.

The value of Government and railroad property involved, including the buildings and their contents, was \$1,946,417.61; the total loss is estimated at \$14,551.71 in Government property and \$2 in property of the Panama Railroad. The value of private property involved is estimated at \$46,595 and the estimated loss was \$6,823.25, making the total estimated property value \$1,993,012.61, with a total estimated fire loss of \$21,376.96.

The largest fire in the Canal Zone occurred on January 3, 1914, in a pile of creosoted and untreated piling stored about three-fourths of a mile south of the shops at Balboa, where it was impossible to drive the fire apparatus. After considerable delay and difficulty, the automobile fire engine was loaded on a railroad flat car and hauled to the scene. The loss to the Government amounted to \$11,998.56 and the

value of the property involved was estimated at \$130,441. There were six other fires in Government property where the losses were from \$100 to \$1,200. The latter was in the file office of the water purification plant at Miraflores on April 15, 1914.

There were three private fires in the Canal Zone in which the losses sustained amounted to, respectively, \$100, \$120, and \$6,300. The latter was at New Gatun on October 14, 1913, in a two-story frame tenement house containing 72 rooms. The fire spread to an adjoining two-story frame building and the two buildings burned.

There were no deaths caused by fire during the year. Three volunteer silver employees were slightly injured by falling material, one silver employee was seriously injured by an explosion in an oil compartment of the dredge *Corozal*, and an American employee received burns about the hands while extinguishing a small fire at the Gatun hydroelectric plant.

COURTS.

On April 1, 1914, the courts of the Canal Zone, organized as described in previous annual reports, ceased to exist, pursuant to the provisions of the Executive order of March 12, 1914, issued under authority of the Panama Canal act, approved August 24, 1912, with the exception of the supreme court, which went out of existence on June 30, 1914.

The judiciary created by the act of Congress above cited consists of one district court and two magistrate courts. The district court consists of two divisions, known as the Balboa Division and the Cristobal Division.

The Balboa Division of the district court includes all that part of the Canal Zone which lies within the lines of the 10-mile zone and extends from the south bank of the Chagres River and the shore line of Gatun Lake, 87 feet above mean sea level, to the Pacific Ocean; and the Cristobal Division of said court includes all of the territory within the lines of the 10-mile zone extending from the Balboa Division to the Atlantic Ocean and the area of Gatun Lake beyond the lines of the 10-mile zone up to the contour line of 100 feet above mean sea level and the islands in said lake, and the peninsulas bordering on said lake which have been taken by the United States for the purposes of The Panama Canal.

There is a magistrate court for each of the towns of Balboa and Cristobal. The Canal Zone is divided into two subdivisions known as the subdivision of Balboa and the subdivision of Cristobal. The limits of these subdivisions are the same as those for the divisions of the district court. The town of Balboa includes the town site at the Pacific terminal of the canal of that name, and the other settlements within the Balboa subdivision; and the town of Cristobal includes the town site of that name and the other settlements within the Cristobal subdivision.

The organization of the judiciary consists of one district judge, one marshal, one deputy marshal, one clerk of the court, one assistant clerk of the court, six clerks, two magistrates, and two constables.

The district court has original jurisdiction of all felony cases, all causes in equity and admiralty, and all cases at law involving principal sums exceeding \$300 and all appeals from judgments rendered

in magistrate courts. The jurisdiction in admiralty of the district judge and the district court is the same as that exercised by the United States district courts and the procedure and practice are also the same. The Circuit Court of Appeals of the Fifth Circuit of the United States has jurisdiction to review, revise, modify, reverse, or affirm the final judgments and decrees of the district court of the Canal Zone in certain cases, and final appeal may be had to the Supreme Court of the United States in the same manner as appeals from the district courts of the United States.

The magistrate courts have exclusive original jurisdiction throughout the subdivision in which situated, of all civil cases in which the principal sum claimed does not exceed \$300, and all criminal cases wherein the punishment that may be imposed does not exceed a fine of \$100, or imprisonment not exceeding 30 days, or both, and all violations of police regulations and ordinances and all actions involving possession or title to personal property or the forcible entry and detainer of real estate. The magistrates also hold preliminary investigations in charges of felony, and commit or bail in bailable cases to the district court.

During the year the Supreme Court of the Canal Zone held 24 sessions, and disposed of 29 cases—3 criminal, 25 civil, and 1 habeas corpus case. The circuit court of the third judicial circuit at Cristobal held its last regular criminal session on March 26, 1914; at Ancon the last regular session of the circuit court of the first judicial circuit was held on March 30, 1914; and at Empire the last regular session of the circuit court of the second judicial circuit was held on March 31, 1914. While all further business relating to these courts was formally ordered over to the new district court on April 1, they continued to act on civil cases until May 1, pending the confirmation of the appointment of the new district judge.

In the circuit courts during the period July 1, 1913, to May 1, 1914, there were 395 criminal cases filed, and there were 4 criminal cases pending on July 1, 1913, making a total of 399. Of this total, 370 cases were disposed of, leaving 29 criminal cases pending on May 1, 1914. Of the 370 cases disposed of, the defendants were convicted in 262 cases and 75 were acquitted, 10 cases were dismissed, 18 cases were nolle prossed, 3 were forfeited, and 2 were suspended.

There were 158 civil cases filed during the period, and 51 civil cases were pending on July 1, 1913, making a total of 209 civil cases. Of this number 179 were disposed of, leaving 30 civil cases pending on May 1, 1914. There were 435 probate cases filed, which with the 57 probate cases pending on July 1, 1913, made a total of 492 probate cases before the court. Of this number, 454 were settled, leaving 38 pending on May 1, 1914. There were also 22 insane cases settled during the period. The circuit courts held 225 sessions, and the collections amounted to \$6,327.57.

The district courts were discontinued on April 1, 1914. During the period July 1, 1913, to April 1, 1914, there were 4,183 cases settled, 527 civil and 3,656 criminal. There were pending on July 1, 1913, 35 civil and 3 criminal cases, and there was pending on April 1, 1914, when the courts closed, 1 civil case. Of the 3,656 criminal cases settled, the defendants were convicted in 2,639 cases, and 500 were acquitted; there were 363 cases committed to the circuit courts, 8

cases settled under sections 359 and 360 of the Laws of the Canal Zone, and 1 case forfeited. The collections from court fees and final amounted to \$12,539.38.

In the district court, divisions of Balboa and Cristobal, under the new judicial system, during the months of May and June, 1914, there were 206 cases settled, 9 civil, 120 probate, and 77 criminal. Of the 77 criminal cases disposed of, 46 were convictions and 23 were acquittals. There were 3 cases dismissed, 1 suspended, 1 forfeited, and 3 nolle prossed. On July 1, 1914, there were 86 cases pending, 36 civil, 36 probate, and 14 criminal. During the two months of the fiscal year the court held 27 sessions, and the collections amounted to \$1,018.70.

In the magistrate courts there were 1,220 cases docketed during the period April 1 to June 30, 1914, of which 82 were civil and 1,138 criminal. On April 1, 1914, there was 1 civil case pending, making a total of 1,221 cases before the court during the above period. Of this total 1,203 cases were settled, 73 civil and 1,130 criminal, leaving 18 cases pending on July 1, 1914, 10 civil and 8 criminal. Of the 1,130 criminal cases settled, there were 905 convictions and 125 acquittals; 28 cases were dismissed and 72 cases were committed to the district court. The collections from court fees and fines amounted to \$3,838.70.

MARSHAL.

The office of the marshal of the district court is created and his duties are defined in section 8 of the Panama Canal act, approved August 24, 1912. He is assisted by one deputy marshal.

Prior to April 1, 1914, the duties of marshal were performed by the chief of the division of police and prisons as acting marshal.

Three thousand and thirteen writs of process in civil and criminal cases were served during the year and a total of \$10,322.39 was collected and disbursed by the marshal and his deputy. Of this number 2,713 were served during the nine months ended March 31, 1914, and \$10,129.09 were collected and disbursed.

RELATIONS WITH PANAMA AND FOREIGN REPRESENTATIVES.

Negotiations by correspondence or personal conference between the head of the executive office and the secretary of foreign affairs of the Republic of Panama included, among others, the following subjects in addition to routine matters: the enforcement of the quarantine regulations; the establishment of rates for the transportation of passengers by automobile between points in the Canal Zone and points in the cities of Panama and Colon; the enforcement of sanitary rules and regulations; the use of revenue stamps on bills submitted by the Isthmian Canal Commission and the Panama Railroad Co. against the Government of Panama; the new contract for street cleaning and garbage removal in the city of Panama; charge for interments made in the Canal Zone of the remains of persons who resided in the Republic; water supply for the village of Taboga; certification by Panamanian consuls of manifests of ships clearing for ports of the Canal Zone; jurisdiction of the United States over islands and peninsulas in the Republic formed by the waters of

Gatun Lake; the sale in the Republic of dynamite stolen from The Panama Canal; the collection of burial fees for interments in Canal Zone cemeteries of indigents from the Republic; the assessment of a commercial tax by the Republic on steamers of the Panama Railroad Steamship Co.; improvements in the Chorrillo district of the city of Panama; misuse of transportation issued to employees of the Republic; modification of the existing arrangement for the purchase of postage stamps used in the Canal Zone; the sale of the Old Administration Building in the city of Panama; water supply for the section of Panama known as "El Hatillo;" cooperation of Panama health officers with those of the Zone in an effort to prevent the introduction of plague into Panama from infected ports on the west coast of South America; enforcement of the exclusion law in the Canal Zone; the use in Canal Zone post offices of United States postage due stamps; modification of the existing agreement respecting the release of mail parcels received by gold employees through the Canal Zone post offices; the arrest in Panama of Panama Canal employees while engaged in the discharge of their duties; the care of patients by the Health Department for the Republic in consideration of the withdrawal of the request of the Panaman Government for the establishment of an independent hospital in the city of Colon; the removal of garbage and street cleaning in the city of Panama; the construction in the Republic of military trails at the expense of the United States; the segregation of stables in the city of Panama within certain defined areas; the desirability of having the Panaman Government cancel the licenses for five saloons near the Zone boundary line in the Folks River district; the granting of commissary privileges to certain persons not connected with The Panama Canal or the Panama Railroad Co.; the deportation of an American in the city of Panama charged with fraudulently representing himself as an attorney licensed to practice in the Canal Zone courts; the deportation of criminal characters from the Canal Zone; the violation of quarantine regulations; the securing of statistics concerning the health conditions in the interior towns of the Republic; promulgation by Panama of a resolution with reference to manifests of vessels arriving at ports of the Canal Zone with cargo for consignees in the Republic of Panama; substitution of properly surcharged stamps of the Republic for surcharged United States postage due stamps being used in Canal Zone post offices; installation and cost of municipal improvements in the area in the city of Colon set aside for the erection of manufacturing plants; protection of the revenues of Panama in connection with parcel post entries into the Canal Zone; and the admission to Ancon Hospital as pay patients of Americans residing in the Republic of Panama, who, on account of the character of their employment, are not entitled to hospital privileges.

The correspondence conducted with members of the diplomatic and consular corps accredited to the Republic of Panama, whose jurisdiction extends to the Canal Zone, related largely to advice of appointments and recognition by the Republic of Panama, the furnishing of transportation over the Panama Railroad, and questions affecting the rights of aliens employed or residing in the Canal Zone.

The relations of The Panama Canal with the Republic of Panama and with foreign representatives continue satisfactory.

LEGISLATION.

Eight acts of Congress and one joint resolution affecting The Panama Canal and the Canal Zone were enacted during the period covered by this report, as follows:

1. The act of October 22, 1913, making appropriations to supply urgent deficiencies in appropriations for the fiscal year 1913, and for other purposes, in which it is also provided that the money accounts of The Panama Canal shall continue to be audited by the Auditor for the War Department.

2. The act of March 12, 1914, authorizing the President of the United States to locate, construct, and operate railroads in the Territory of Alaska, in which The Panama Canal is authorized to deliver to such persons as the President may designate for this work any surplus canal machinery, equipment, material, etc., when the same is no longer needed at Panama.

3. The act of April 6, 1914, making appropriations to supply urgent deficiencies in appropriations for the fiscal year 1914 and for prior years, and for other purposes.

4. The act of June 15, 1914, amending section 5 of the Panama Canal act, providing for the repeal of tolls exemption for coastwise vessels.

5. The act of January 17, 1914, amending the act of February 6, 1909, prohibiting the importation and use of opium for other than medicinal purposes.

6. The act of June 24, 1914, authorizing and directing the Governor of the Canal Zone to investigate certain claims of the McClintic-Marshall Construction Co.

7. The act of June 30, 1914, making appropriations for the Diplomatic and Consular Services for the fiscal year ending June 30, 1915, providing for the relief and protection of American seamen in the Canal Zone and foreign countries.

8. The act of June 30, 1914, making appropriations for the naval service for the fiscal year ending June 30, 1915, providing for radio stations in the Canal Zone and for the entertainment of foreign war vessels attending the Panama-Pacific International Exposition.

The joint resolution approved on June 30, 1914, extends the appropriations for the necessary operations of the Government until the appropriation bill for the fiscal year ending June 30, 1915, shall have been passed.

Twenty-two orders signed by the President, having the effect of law in the Canal Zone, were issued during the year, as follows:

The order of August 7, 1913, prohibiting the unauthorized use of flying machines in the Canal Zone.

The order of August 9, 1913, appointing Richard L. Metcalfe a member of the Isthmian Canal Commission.

The order of August 29, 1913, relating to bail bonds and money deposits in lieu thereof, and amending section 310 of the Criminal Procedure of the Canal Zone.

The order of September 20, 1913, extending the leave of absence of Lieut. Col. D. D. Gaillard, United States Army, a member of the Isthmian Canal Commission.

The order of September 25, 1913, providing for the punishment of deported persons who return to the Canal Zone.

The order of November 7, 1913, regulating the carrying of firearms.
The order of November 11, 1913, fixing the rate of interest on money.

The order of November 21, 1913, prescribing rules for the admeasurement of vessels for The Panama Canal.

The order of January 20, 1914, naming the total compensation for Prof. Emory R. Johnson, special commissioner.

The order of January 21, 1914, making unlawful the corrupt influencing of agents, employees, or servants.

The order of January 27, 1914, providing for a permanent organization for The Panama Canal.

The order of January 27, 1914, preventing fire hunting at night and hunting by means of a spring or trap, and repealing the order of September 8, 1909.

The order of February 2, 1914, providing conditions of employment for the permanent force of The Panama Canal.

The order of March 2, 1914, establishing a Washington office of The Panama Canal, and providing temporarily for the organization, officials, and employees thereof, and continuing in force for The Panama Canal rules, regulations, and Executive orders made for the Isthmian Canal Commission.

The order of March 12, 1914, relating to the Canal Zone judiciary.

The order of March 20, 1914, providing compensation for personal injuries.

The order of April 16, 1914, prescribing regulations relative to the payment of tolls and bills for material, supplies, repairs, harbor pilotage, and other services furnished to vessels by The Panama Canal.

The order of May 8, 1914, providing for the payment of the members of the Joint Land Commission.

The order of May 13, 1914, approving acts and resolutions of the Isthmian Canal Commission passed since February 28, 1907.

The order of May 13, 1914, relating to pardons and remission of fines and forfeitures.

The order of May 20, 1914, creating a committee to formally and officially open The Panama Canal.

The order of May 26, 1914, setting apart and assigning an area of land for the Balboa naval radio station.

Two ordinances were enacted by the Isthmian Canal Commission during the year and approved by the Secretary of War, as follows:

Ordinance approved October 3, 1913, prohibiting the passage or presence of floating craft, except those belonging to the United States or the Panama Railroad Co., in that section of the canal between Gamboa and Pedro Miguel Lock known as the Culebra Cut.

Ordinance approved February 14, 1914, amending section 8 of Ordinance No. 24, providing for the licensing of chauffeurs for automobiles.

APPENDIXES TO REPORT OF THE EXECUTIVE SECRETARY.

APPENDIX I.

- TABLE 1. Customs operations at the port of Ancon during the fiscal year ended June 30, 1914.
- TABLE 2. Customs operations at the port of Cristobal during the fiscal year ended June 30, 1914.
- TABLE 3. Statement, by months, of estates of deceased and insane employees administered by the administrator of estates during the fiscal year ended June 30, 1914.

APPENDIX II.

- TABLE 4. Sale of postage stamps and collections on account of second-class matter, by months, during the fiscal year ended June 30, 1914.
- TABLE 5. Letters and parcels registered, by offices, during the fiscal year ended June 30, 1914.
- TABLE 6. Number of dispatches from the exchange office at Cristobal, and number of pouches, sacks, and registered sacks handled by railway mail messengers during the fiscal year ended June 30, 1914.
- TABLE 7. Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1914.
- TABLE 8. Money orders issued, by months, during the fiscal year ended June 30, 1914.
- TABLE 9. Amount of money orders, by offices, payable to the remitter and drawn on the issuing office, remaining unpaid on June 30, 1914.
- TABLE 10. Number and amount of postal savings accounts opened, including those remaining open on June 30, 1913, at each post office during the fiscal year ended June 30, 1914, together with the number and amount remaining open on June 30, 1914.
- TABLE 11. Number and nationalities of postal savings depositors having open accounts in Canal Zone post offices on June 30, 1914.

APPENDIX III.

- TABLE 12. Actual strength of stations and substations on June 30, 1914.
- TABLE 13. Actual strength of division of police and prisons on June 30, 1914.
- TABLE 14. Number of arrests, by fiscal years, made in the Canal Zone since organization of division of police and prisons.
- TABLE 15. Number of arrests, by months, made during the fiscal year ended June 30, 1914.
- TABLE 16. Statement of convictions of persons arrested during the fiscal year ended June 30, 1914.
- TABLE 17. Charges against persons arrested during the fiscal year ended June 30, 1914.
- TABLE 18. Nationality of persons arrested during the fiscal year ended June 30, 1914.
- TABLE 19. Arrests, by stations, during the fiscal year ended June 30, 1914.
- TABLE 20. Occupations of persons arrested during the fiscal year ended June 30, 1914.
- TABLE 21. Crimes committed by prisoners confined in the penitentiary June 30, 1914.
- TABLE 22. Occupations of prisoners confined in the penitentiary June 30, 1914.
- TABLE 23. Nationality of persons confined in the penitentiary June 30, 1914.
- TABLE 24. Ages of prisoners confined in the penitentiary June 30, 1914.
- TABLE 25. Causes of deaths investigated by the coroner during the fiscal year ended June 30, 1914.
- TABLE 26. Nationality of persons whose deaths were investigated by the coroner during the fiscal year ended June 30, 1914.
- TABLE 27. Statement of accidents involving personal injury investigated during the fiscal year ended June 30, 1914.

APPENDIX IV.

- TABLE 28. Net monthly enrollment and average daily attendance in white and colored schools during the fiscal year ended June 30, 1914.
- TABLE 29. Total enrollment for the year, by schools.
- TABLE 30. Net enrollment, by grades.
- TABLE 31. Number of teachers employed

APPENDIX V.

- TABLE 32. Business transacted in the Supreme Court of the Canal Zone.
- TABLE 33. Business transacted in the first circuit court.
- TABLE 34. Business transacted in the second circuit court.
- TABLE 35. Business transacted in the third circuit court.
- TABLE 36. Business transacted in the district court, division of Balboa.
- TABLE 37. Business transacted in the district court, division of Cristobal.
- TABLE 38. Business transacted in the district court, district of Ancon.
- TABLE 39. Business transacted in the district court, district of Empire.
- TABLE 40. Business transacted in the district court, district of Cristobal.
- TABLE 41. Business transacted in the magistrate court, subdivision of Balboa.
- TABLE 42. Business transacted in the magistrate court, subdivision of Cristobal.

APPENDIX VI.—*Legislation.*

(For Executive orders, see Appendix L.)

ORDINANCES.

- 1. Ordinance approved by the Secretary of War on October 3, 1913.
- 2. Ordinance enacted by the Isthmian Canal Commission on February 3, 1914, and approved by the Secretary of War on February 14, 1914.

APPENDIX I.

TABLE 1.—*Customs operations at the port of Ancon during the fiscal year ended June 30, 1914.*

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam...	90	226,891	88	220,896
British.....	do.....	114	187,762	114	184,148
Peruvian.....	do.....	46	98,217	45	95,679
Chilean.....	do.....	26	49,352	26	49,352
Norwegian.....	do.....	3	8,259	3	8,259
Panamanian.....	do.....	1	100	1	100
Total.....		280	570,581	277	558,434

Number of vessels in port from last year.....	4
Tonnage in port from last year.....	6,676
Number of vessels remaining in port.....	7
Tonnage remaining in port.....	18,023
Services to American seamen:	
Seamen shipped.....	739
Seamen discharged.....	600
Seamen deserted.....	66
Movement of passengers and cargo:	
Tons of cargo arriving, in transit.....	307,344
Tons of cargo arriving, local.....	48,805
Number of barrels of oil arriving, local.....	707,500
Tons of cargo departing, in transit.....	331,515
Tons of cargo departing, local.....	4,293
Passengers arriving:	
Cabin.....	4,745
Steerage.....	1,831
Total.....	6,579
Passengers departing:	
Cabin.....	4,363
Steerage.....	1,959
Total.....	6,322
Services to Chinese, Syrians, Turks, Egyptians, etc.:	
Chinese arriving.....	191
Chinese transferred to other ships.....	44
Chinese returned to port of embarkation.....	3
Syrians arriving, in transit.....	62
Turks arriving, in transit.....	1
Egyptians arriving, in transit.....	8
Arabs arriving, in transit.....	12

TABLE 2.—*Customs operations at the port of Cristobal during the fiscal year ended June 30, 1914.*

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam.....	91	324,099	91	327,931
British.....	...do....	79	272,315	80	272,980
Norwegian.....	...do....	93	164,695	94	166,420
German.....	...do....	15	62,157	15	62,157
Swedish.....	...do....	3	3,876	3	3,876
Danish.....	...do....	2	2,072	2	2,072
Italian.....	...do....	1	2,294	1	2,294
British.....	Schooner.....	3	727	2	634
Panamanian.....	...do....	8	344	8	344
Total.....		295	832,579	296	838,708

Number of vessels in port from last year.....	4
Tonnage in port from last year.....	12,343
Number of vessels remaining in port.....	3
Tonnage remaining in port.....	6,214
Services to American seamen:	
Seamen shipped.....	85
Seamen discharged.....	35
Seamen deserted.....	31
Seamen deceased.....	1
Movement of passengers and cargo:	
Tons of cargo arriving, in transit.....	144,815
Tons of cargo arriving, local.....	649,533
Tons of cargo departing, in transit.....	179,254
Tons of cargo departing, local.....	28,776
Passengers arriving:	
Cabin.....	9,757
Steerage.....	1,993
Total.....	11,750
Passengers departing:	
Cabin.....	9,657
Steerage.....	3,769
Total.....	13,426

TABLE 3.—Statement, by months, of estates of deceased and insane employees administered by the administrator of estates during the fiscal year ended June 30, 1914.

Month.	Number received.	Number settled.	Amount of funds collected.
On hand unsettled July 1, 1913.....	78		\$7,728.12
1913.			
July.....	18	4	3,459.72
August.....	23	44	2,704.46
September.....	46	44	2,976.14
October.....	14	45	1,179.80
November.....	30	30	3,868.02
December.....	71	53	3,053.30
1914.			
January.....	23	28	1,454.03
February.....	26	23	610.41
March.....	47	64	3,728.54
April.....	27	27	2,593.32
May.....	35	55	2,309.99
June.....	34	35	2,162.53
Total.....	472	452	37,828.38

Number of estates remaining unsettled June 30, 1914, 20.

APPENDIX II.—DIVISION OF POSTS.

TABLE 4.—Sale of postage stamps and collections on account of second-class matter, by months, during the fiscal year ended June 30, 1914.

Month.	First class.	Second class.	Month.	First class.	Second class.
1913.			1914.		
July.....	\$8,753.74	\$52.68	January.....	\$7,575.00	\$33.83
August.....	8,147.17	52.05	February.....	6,542.71	28.45
September.....	7,872.03	52.24	March.....	7,145.70	35.81
October.....	7,671.00	42.52	April.....	6,634.25	32.76
November.....	7,050.90	25.00	May.....	6,420.74	36.72
December.....	10,026.20	37.91	June.....	6,751.14	33.70
			Total.....	90,590.63	463.67

TABLE 5.—*Letters and parcels registered, by offices, during the fiscal year ended June 30, 1914.*

Name of post office.	Domestic letters registered.	Domestic parcels registered.	Foreign letters registered.	Foreign parcels registered.	Official, registered free.	Distribution registered free.	Total.
Ancon.....	4,538	1,145	9,534	827	8,986	.....	25,030
Balboa.....	1,439	310	3,331	276	5,977	216	11,549
Bas Obispo.....	122	26	181	8	563	66	966
Corozal.....	1,103	247	1,994	71	2,723	173	6,311
Cristobal.....	5,152	834	12,345	598	7,061	556	26,546
Culebra.....	1,031	256	2,747	96	20,549	150	24,849
Empire.....	1,954	298	5,104	168	16,672	335	24,531
Frijoles.....	10	.....	10	.....	2	.....	22
Gamboa.....	26	1	65	6	27	1	126
Gatun.....	1,229	193	3,438	66	3,489	300	8,715
Las Cascadas.....	783	179	596	21	946	102	2,627
Matachin.....	6	2	78	2	44	15	147
Miraflores.....	87	3	293	3	298	16	700
Paraiso.....	712	137	1,961	60	2,132	99	5,101
Pedro Miguel.....	511	103	1,184	17	1,878	196	3,889
Total.....	18,703	3,734	42,861	2,219	71,347	2,225	141,089

TABLE 6.—*Number of dispatches from the exchange office at Cristobal and number of pouches, sacks, and registered sacks handled by railway mail messengers during the fiscal year ended June 30, 1914.*

Month.	Pouches.	Sacks.	Registered sacks.	Total.	Dispatches.
1913.					
July.....	4,269	1,609	405	6,283	125
August.....	3,538	1,444	405	5,387	112
September.....	4,441	1,802	363	6,606	101
October.....	4,608	1,324	391	6,323	112
November.....	4,222	1,490	356	6,068	105
December.....	5,017	1,983	451	7,451	123
1914.					
January.....	4,678	1,576	223	6,477	120
February.....	4,277	1,223	230	5,730	103
March.....	4,367	1,524	117	6,008	111
April.....	3,962	1,641	221	5,824	106
May.....	4,208	1,409	233	5,850	110
June.....	4,132	1,551	248	5,931	116
	51,719	18,576	3,643	73,938	1,344

TABLE 7.—*Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1914.*

Destination.	Number of dis-patches.	Destination.	Number of dis-patches.
New York, by Panama Railroad and United Fruit steamers.....	85	Dominica.....	14
New Orleans, La. (States mail).....	63	Grenada.....	27
Key West, Fla.....	1	Montserrat.....	27
Jamaica.....	105	Nevis.....	17
Barbados and distribution.....	27	St. Kitts.....	14
Trinidad and distribution.....	42	St. Lucia.....	27
French lines, Colon-Bordeaux, Colon-St. Nazaire.....	25	St. Vincent.....	27
Martinique.....	26	Colombia.....	61
Guadeloupe.....	13	Port Limon, Costa Rica.....	62
Antigua.....	27	Colon, Republic of Panama.....	608
British Guiana.....	5	Bocas del Toro, Republic of Panama.....	8
Demerara.....	22	Total.....	1,333

TABLE 8.—*Money orders issued, by months, during the fiscal year ended June 30, 1914.*

Month.	Orders issued.	Amount.	Paid and repaid.	Fees.
1913.				
July.....	19,361	\$400,092.72	\$87,837.06	\$1,906.90
August.....	18,687	402,931.50	86,386.97	1,890.18
September.....	18,049	406,484.56	84,850.47	1,868.85
October.....	16,841	340,910.46	71,836.86	1,643.01
November.....	18,052	360,567.01	72,231.64	1,749.03
December.....	19,365	354,654.96	83,508.43	1,784.69
1914.				
January.....	15,771	306,067.03	65,531.71	1,503.91
February.....	14,170	282,886.96	55,213.02	1,383.33
March.....	15,159	296,510.00	67,628.42	1,449.10
April.....	14,361	295,157.77	69,558.46	1,411.88
May.....	14,332	293,501.56	64,957.74	1,407.64
June.....	14,680	289,600.30	55,452.80	1,409.89
Total.....	198,828	4,029,364.83	864,993.58	19,408.41

Average value of orders, \$20.26.

TABLE 9.—*Amount of money orders, by offices, payable to the remitter and drawn on the issuing office, remaining unpaid on June 30, 1914.*

Office.	Amount.	Office.	Amount.
Ancon.....	\$5,541.05	Gatun.....	\$8,769.40
Balboa.....	16,427.95	Las Cascadas.....	790.00
Corozal.....	11,652.75	Paraiso.....	8,529.75
Cristobal.....	7,557.00	Pedro Miguel.....	5,102.00
Culebra.....	2,136.25		
Empire.....	4,244.26	Total.....	70,750.41

TABLE 10.—*Number and amount of postal-savings accounts opened, including those remaining open on June 30, 1913, at each post office during the fiscal year ended June 30, 1914, together with the number and amount remaining open on June 30, 1914.*

Office.	Total number of accounts opened.	Number remaining open on June 30, 1914.	Value of certificates issued.	Value of certificates paid.	Balance on deposit.
Ancon.....	609	381	\$185,556	\$181,067	\$4,489
Balboa.....	643	313	235,781	247,914	.....
Bas Obispo.....	.....	.....	15,081	16,484	.....
Corozal.....	887	394	349,250	370,726	.....
Cristobal.....	425	247	156,332	147,128	9,204
Culebra.....	268	118	101,185	112,612	.....
Empire.....	1,013	102	176,637	197,597	.....
Gatun.....	354	186	154,093	163,741	.....
Gorgona.....	.....	.....	5,320	22,739	.....
Las Cascadas.....	350	104	62,409	76,037	.....
Matachin.....	.....	.....	201	7,178	.....
Miraflores.....	.....	.....	7,750	36,581	.....
Paraiso.....	350	197	124,459	128,071	.....
Pedro Miguel.....	214	138	104,890	118,275	.....
Cristobal, Station A.....	.....	.....	13,051	12,823	228
Cristobal, Station B.....	.....	.....	16,535	16,766	.....
Total.....	5,113	2,150	1,708,530	1,855,739	13,921
Balance at close of fiscal year ended June 30, 1913.....	.....	.....	.....	.....	645,690
Excess of amount paid over amount issued.....	.....	.....	.....	.....	659,611
On deposit June 30, 1914.....	.....	.....	.....	.....	161,130
					498,481

TABLE 11.—*Number and nationalities of postal savings depositors having open accounts in Canal Zone post offices on June 30, 1914.*

Nationality.	An-con.	Bal-bo.	Coro-zal.	Cris-tobal	Cule-bra.	Em-pire.	Ga-tun.	Las Cas-cadas.	Pa-raiso.	Ped-ro Miguel.	Total.
Antigua.....	3			2	1	3		1	3	3	16
Australia.....							1				1
Austria.....				1	1		1	3		1	7
Barbados.....	28		22	5	20	9	11	1	15	16	127
British Guiana.....	4		4				1		3	3	15
Canada.....			5	2		1				1	9
Chile.....									1		1
China.....									1		1
Colombia.....		1				1					2
Costa Rica.....			1	1							2
Demerara.....								1			1
Denmark.....		1	2	1			3		1		8
Dominica.....							1				1
Ecuador.....					1						1
England.....		6	8	5	4	2	9		4		38
Finland.....				1					1		2
France.....		3		1		1	1				6
Germany.....		7	6	3		1	1	1			19
Grand Cayman.....				2		1			6		9
Greece.....		4					1	2	1		8
Grenada.....	8		3		3	1	2	1	6	4	28
Guadeloupe.....					3						3
Holland.....		1						1			2
Hungary.....				2				3			5
Inagua.....									2		2
Ireland.....		4	4	5		1		2	1	1	18
Italy.....	1	2	3	1				3		1	11
Jamaica.....	77		54	20	14	20	6	8	48	10	257
Madagascar.....									1		1
Martinique.....			1					1			2
Montserrat.....	4				6		2		4		16
Nevis.....	4		1								5
Norway.....			2	2			1			1	6
Panama.....	2	2							3	1	8
Peru.....				1					1		2
Portugal.....	1										1
Russia.....		3	4		1		1	7			16
Roumania.....				1							1
Scotland.....		2	4	3					1		10
Spain.....	1	17	6	2		4	1	2	1	3	37
Sweden.....		2	1	6		2		1			12
Switzerland.....				1	1						2
St. Kitts.....	3										3
St. Lucia.....			2		1	2				1	6
St. Thomas.....										1	1
St. Vincent.....	13		9	1		1	2		5	5	36
Trinidad.....	3		4	1	1	2	5				16
Turkey.....								1			1
Turks Island.....				1							1
United States.....	229	189	248	173	63	53	134	65	87	87	1,328
West Indies.....		69									69
	381	313	394	247	118	102	186	104	197	138	2,180

APPENDIX III.

TABLE 12.—*Actual strength of stations and substations, division of police and prisons, on June 30, 1914.*

Station.	Substation.	Strength.
Headquarters.....		10
Detective force.....		4
Ancon.....		44
	Naos Island.....	1
	Sabanas.....	1
	Corozal.....	4
	Pedro Miguel.....	18
Empire.....		20
	Culebra.....	9
	Frijoles.....	1
	Gamboa.....	1
Cristobal.....		50
	Monte Lirio.....	1
	Gatun.....	16
	Colon Hospital.....	1
Penitentiary.....		21
Total.....		202

TABLE 13.—*Actual strength of division of police and prisons on June 30, 1904-1914.*

Official title.	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
Chief of police.....	1	1	1	1	1	1	1	1	1	1	1
Assistant chief of police.....							1	1	1	1	
Chief clerk.....		1	1	1	1	1					
Senior clerk.....							1	1	1	1	1
Clerks.....	1	4	5	6	8	5	4	4	4	4	5
Copyist.....					1						
Inspectors.....							2	2	2	1	1
First lieutenant.....	1	1	1	1	1	1					
Second lieutenant.....			1	1	1	1					
Lieutenants.....							4	4	4	3	3
First-class sergeants.....		4	9	6							
Sergeants.....	6	4	9	6	10	11	8	8	8	8	7
Corporals.....	2	3	15	13	18	18	20	20	19	15	15
First-class policemen.....		16	23	59	108	117	112	114	114	111	99
Policemen.....	75	98	155	90	93	96	111	115	107	89	68
Policeman, launch engineer.....						1					1
Police launch, sailor.....						1					
Messenger.....											1
Total.....	86	132	220	184	242	253	264	270	261	234	202

TABLE 14.—*Number of arrests, by fiscal years, made in the Canal Zone since organization of division of police and prisons.*

Period.	Arrests.	Period.	Arrests.
June 2, 1904, to June 30, 1905.....	2,130	July 1, 1910, to June 30, 1911.....	5,959
July 1, 1905, to June 30, 1906.....	3,748	July 1, 1911, to June 30, 1912.....	7,055
July 1, 1906, to June 30, 1907.....	5,831	July 1, 1912, to June 30, 1913.....	6,827
July 1, 1907, to June 30, 1908.....	6,075	July 1, 1913, to June 30, 1914.....	4,911
July 1, 1908, to June 30, 1909.....	6,275		
July 1, 1909, to June 30, 1910.....	6,947	Total.....	55,758

TABLE 15.—*Number of arrests, by months, made during the fiscal year ended June 30, 1914.*

1913.		1914.	
July.....	501	January.....	422
August.....	484	February.....	432
September.....	399	March.....	390
October.....	385	April.....	391
November.....	317	May.....	369
December.....	427	June.....	394
		Total.....	4,911
		Arrests with warrant.....	1,187
		Arrests without warrant.....	3,724

TABLE 16.—*Statement of convictions of persons arrested during the fiscal year ended June 30, 1914.*

	Total arrested.	Convictions.		Total arrested.	Convictions.
1913.			1914.		
July.....	501	387	January.....	422	338
August.....	484	387	February.....	432	353
September.....	399	322	March.....	390	310
October.....	385	300	April.....	391	314
November.....	317	238	May.....	369	301
December.....	427	348	June.....	394	329
			Total.....	4,911	3,927

TABLE 17.—Charges against persons arrested during the fiscal year ended June 30, 1914.

Offense.	Male.	Female.	Total.	Offense.	Male.	Female.	Total.
Abusive language.....	2	1	3	Nonsupport.....	29	.....	29
Adultery.....	7	7	14	Obtaining food by false pretenses.....	2	.....	2
Aiding and abetting escape of prisoner.....	1	.....	1	Obtaining property by false pretenses.....	6	.....	6
Alighting from moving train.....	136	.....	136	Obscene and indecent language.....	10	5	15
Allowing unmuzzled dog to run at large.....	1	.....	1	Obtaining money by false pretenses.....	6	.....	6
Assault.....	17	1	18	Peddling without a license.....	1	.....	1
Assault and battery.....	345	68	413	Practicing pharmacy without a license.....	1	.....	1
Assault with deadly weapon.....	37	1	38	Practicing medicine without a license.....	1	.....	1
Assault with intent to commit rape.....	1	.....	1	Petty larceny.....	340	13	353
Attempt to commit crime against nature.....	1	.....	1	Passing counterfeit money.....	2	.....	2
Attempt to commit grand larceny.....	1	.....	1	Perjury.....	2	.....	2
Attempt to kill.....	3	.....	3	Practicing surgery without a license.....	.....	1	1
Attempt to defraud.....	19	.....	19	Prostitution.....	.....	1	1
Attempted burglary.....	1	.....	1	Rape.....	3	.....	3
Attempted violation of immigration regulations.....	4	.....	4	Receiving stolen property	2	1	3
Battery.....	123	5	128	Resisting an officer.....	5	2	7
Bigamy.....	1	1	2	Returning to Canal Zone after being deported therefrom.....	9	.....	9
Boarding moving train.....	112	2	114	Riding on platform of train.....	115	.....	115
Bringing stolen property into the Canal Zone.....	5	.....	5	Riding on roof of train.....	3	.....	3
Burglary.....	34	3	37	Robbery.....	2	.....	2
Carrying concealed weapons.....	58	.....	58	Seduction.....	1	.....	1
Causing false arrest.....	3	.....	3	Straggling from United States Army.....	10	.....	10
Civil order of arrest.....	28	.....	28	Straggling from United States Marine Corps.....	9	.....	9
Conspiracy.....	5	.....	5	Straggling from United States Navy.....	3	.....	3
Contempt of court.....	20	2	22	Threatening to kill.....	1	.....	1
Crime against nature.....	1	.....	1	Trespass.....	20	1	21
Cruelty to animals.....	39	3	42	Trespassing on railroad train.....	51	.....	51
Desertion from United States Army.....	11	.....	11	Trespassing on watershed.	12	.....	12
Desertion from United States Navy.....	1	.....	1	Unauthorized riding on labor trains.....	22	.....	22
Detained for deportation.....	8	.....	8	Unlawfully possessing game birds.....	1	.....	1
Detained as witness.....	4	.....	4	Vagrancy.....	211	11	222
Disorderly conduct.....	566	128	694	Violating automobile regulations.....	19	.....	19
Disturbing the peace.....	230	67	297	Violating bicycle regulations.....	6	.....	6
Embezzlement.....	37	6	43	Violating building regulations.....	11	.....	11
Escaping from custody.....	4	.....	4	Violating chauffeur's ordinance.....	15	.....	15
Escaping from military authorities.....	2	.....	2	Violating coach tariff regulations.....	38	.....	38
Exhibiting deadly weapon.....	1	.....	1	Violating impounding ordinance.....	57	1	58
Extradition.....	6	.....	6	Violating license regulations.....	13	.....	13
False personation.....	11	.....	11	Violating liquor regulations.....	44	8	52
Felonious assault.....	1	.....	1	Violating lottery laws.....	10	.....	10
Fighting.....	128	6	134	Violating ordinance for the licensing and regulation of motor vehicles.....	20	.....	20
Forgery.....	21	1	22	Violating sanitary regulations.....	196	50	246
Fraud.....	19	.....	19	Violating tax regulations.....	1	.....	1
Fugitive from justice.....	1	.....	1	Violating water regulations.....	1	.....	1
Gambling.....	76	.....	76	Violating immigration regulations.....	3	.....	3
Grand larceny.....	148	5	153	Violating navigation regulations.....	12	.....	12
Having firearms without permit.....	19	.....	19	Total.....	4,563	458	5,021
Hunting with trap.....	5	.....	5				
Indecent exposure.....	17	.....	17				
Insanity.....	9	3	12				
Interfering with an officer.....	2	.....	2				
Intoxication.....	191	3	194				
Intoxication and disorderly conduct.....	208	6	214				
Killing birds.....	1	.....	1				
Lewd and lascivious cohabitation.....	24	23	47				
Libel.....	2	.....	2				
Loitering.....	417	13	430				
Malicious mischief.....	57	5	62				
Malicious prosecution.....	.....	2	2				
Manslaughter.....	4	2	6				
Mayhem.....	1	.....	1				

TABLE 18.—*Nationality of persons arrested during the fiscal year ended June 30, 1914.*

Nationality.	Number.	Nationality.	Number.
Argentine Republic.....	2	Great Britain—Continued.	
Austria.....	4	Jamaica.....	1,018
Chile.....	21	Long Island.....	2
China.....	40	Montserrat.....	24
Colombia.....	195	Nevis Island.....	3
Costa Rica.....	16	New Providence.....	48
Cuba.....	15	St. Christopher.....	4
Denmark.....	2	St. Kitts.....	20
Danish West Indies.....		St. Lucia.....	98
Saba Island.....	1	St. Vincent.....	50
St. Thomas.....	4	Trinidad.....	84
Ecuador.....	21	Turks Island.....	5
Egypt.....	2	Greece.....	39
France.....	20	Guatemala.....	3
French Guiana.....	3	Haiti.....	16
French West Indies.....		Holland.....	5
Guadeloupe.....	64	Dutch Guiana.....	2
Martinique.....	191	Honduras.....	7
St. Martins.....	2	Italy.....	66
Germany.....	23	Japan.....	8
Great Britain—		Mexico.....	35
Australia.....	1	Nicaragua.....	17
British Guiana.....	58	Norway.....	13
British South Africa.....	1	Panama.....	356
British West Africa.....	2	Peru.....	79
Canada.....	2	Portugal.....	5
Ceylon.....	2	Roumania.....	1
England.....	29	Russia.....	1
India.....	52	Finland.....	3
Ireland.....	4	Salvador.....	4
Scotland.....	7	Spain.....	228
Wales.....	1	Sweden.....	9
British West Indies.....		Turkey.....	3
Antigua.....	54	Syria.....	9
Barbados.....	1,279	United States.....	341
Bermuda.....	8	Hawaii.....	1
Cayman Brac.....	1	Porto Rico.....	1
Dominica.....	14	Venezuela.....	7
Fortune Island.....	47		
Grenada.....	84	Total.....	4,911
Inagua.....	4		

TABLE 19.—*Arrests, by stations, during the fiscal year ended June 30, 1914.*

Station.	1913						1914						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Ancon.....	53	40	40	62	48	49	50	43	60	46	38	60	589
Naos Island.....		3	5			2	1				2		13
Balboa.....	47	60	53	43	40	61	55	74	73	75	83	78	742
Las Sabanas.....						1	1		6		5	3	16
Corozal.....	25	23	16	17	16	20	51	40	18	26	18	24	294
Miraflores.....	18	26	3										47
Pedro Miguel.....	65	31	31	13	15	30	20	46	31	13	21	19	335
Paraiso.....										3	4	7	14
Empire.....	82	102	68	72	64	65	59	44	53	47	27	33	716
Paraiso.....	6	12	10	13	6	20	14	18	26	26			147
Culebra.....	41	40	44	30	29	26	22	31	22	31	43	31	390
Las Cascadas.....	2	8	8	5	3	3							29
Bas Obispo.....	15	11	6	4	1	1							38
Gorgona.....	10												10
Gamboa.....						1	1	1		1			4
Frijoles.....				1			1	1		3		1	7
Cristobal.....	64	52	42	60	50	72	89	93	66	81	79	96	844
Monte Lirio.....				1		3	2	2	5		2	2	17
Gatun.....	52	56	55	54	38	48	35	20	23	30	35	33	479
Mount Hope.....	9	13	9	4	5	13	10	11	5	9	11	7	106
Toro Point.....	5	1		2	1	2	1				1		13
Porto Bello.....	7	6	9	4	1	10	10	8	2	4			61
Total.....	501	484	399	385	317	427	422	432	390	391	369	394	4,911

TABLE 20.—Occupations of persons arrested during the fiscal year ended June 30, 1914.

Occupation.	Number.	Occupation.	Number.
Agents.....	9	Machinists' helpers.....	14
Attorneys.....	3	Manager.....	1
Bakers.....	35	Marines.....	9
Barbers.....	6	Masons.....	32
Bartender.....	1	Merchants.....	84
Blacksmiths.....	31	Messman.....	1
Blacksmith's helpers.....	5	Messengers.....	26
Boatman.....	1	Midwives.....	3
Boilermakers.....	23	Miner.....	1
Boilermaker's helpers.....	3	Molder.....	1
Bootblacks.....	2	Musicians.....	3
Brakemen.....	77	Newsboys.....	8
Bricklayers.....	2	No occupation.....	301
Butchers.....	14	Oilers.....	7
Butler.....	1	Painters.....	32
Car inspectors.....	2	Pantrymen.....	2
Carpenters.....	137	Peddlers.....	37
Cable splicer.....	1	Photographers.....	2
Car repairer.....	1	Physicians.....	3
Chainmen.....	2	Pipefitters.....	15
Chauffeurs.....	44	Pitmen.....	3
Checkers.....	7	Plasterers.....	2
Cigarmaker.....	1	Plumbers.....	4
Civil engineers.....	3	Policemen.....	4
Clerks.....	73	Porters.....	2
Coachmen.....	73	Powderman.....	1
Collectors.....	3	Printers.....	2
Concrete finishers.....	2	Quartermaster.....	1
Conductors.....	7	Real estate operators.....	11
Contractors.....	2	Restaurant keepers.....	5
Cooks.....	25	Riggers.....	5
Cranemen.....	4	Riveters.....	5
Dishwashers.....	2	Saddler.....	1
Domestics.....	389	Sailors.....	111
Draftsman.....	1	Salesmen.....	8
Dredgemen.....	4	Saloon keeper.....	1
Dressmakers.....	6	Ship's officers.....	10
Drillmen.....	7	Shipwright.....	1
Electricians.....	9	Shoemakers.....	22
Engineers.....	18	Soldiers.....	46
Farmers.....	162	Stevedores.....	3
Firemen.....	65	Stewards.....	8
Fishermen.....	6	Storekeepers.....	7
Flagmen.....	6	Student.....	1
Foremen.....	95	Superintendents.....	3
Gardeners.....	3	Switchtenders.....	41
Goldsmith.....	1	Tailors.....	33
Hatter.....	1	Teamsters.....	46
Hostlers.....	7	Telegraph operators.....	5
Inspectors.....	2	Telephone operators.....	3
Ironworkers.....	19	Time inspector.....	1
Janitors.....	26	Timekeepers.....	6
Jewelers.....	2	Towerman.....	1
Junk dealer.....	1	Waiters.....	26
Laborers.....	2,344	Watchmen.....	14
Laundresses.....	33	Water boys.....	28
Laundrymen.....	3	Winchmen.....	4
Linemen.....	3	Woodworker.....	1
Liverymen.....	2		
Machinists.....	36	Total.....	4,911

TABLE 21.—Crimes committed by prisoners confined in the penitentiary June 30, 1914.

Crimes.	Number.	Crimes.	Number.
Assault with deadly weapon.....	6	Grand larceny.....	32
Assault with intent to murder.....	1	Incest.....	2
Attempt to defraud.....	1	Manslaughter.....	1
Burglary.....	4	Murder (first degree).....	2
Burglary (first degree).....	4	Murder (second degree).....	4
Burglary (second degree).....	6	Obtaining money by false pretenses.....	2
Conspiracy.....	1	Perjury.....	1
Conspiracy to defraud.....	1	Rape.....	3
Crimes against nature.....	2	Returning to Canal Zone after being de- ported therefrom.....	3
Embezzlement.....	1		
Escaping from penitentiary.....	4	Total.....	91
False personation.....	1		
Forgery.....	9		

TABLE 22.—Occupations of prisoners confined in penitentiary June 30, 1914.

Occupation.	Number.	Occupation.	Number.
Baker.....	1	Merchant.....	1
Barber.....	1	Musician.....	1
Brakemen.....	2	No occupation.....	1
Carpenters.....	5	Painters.....	2
Cashier.....	1	Pantryman.....	1
Clerk.....	1	Powdermen.....	2
Coachman.....	1	Riveter.....	1
Cook.....	1	Sailors.....	5
Drillman.....	1	Tailor.....	1
Farmers.....	4	Teamster.....	1
Fishermen.....	2	Timekeeper.....	1
Foremen.....	2	Waterboy.....	1
Laborers.....	31	Winchman.....	1
Mason.....	1		
Mason's helpers.....	2	Total.....	75

TABLE 23.—Nationality of persons confined in the penitentiary June 30, 1914.

Nationality.	Number.	Nationality.	Number.
Colombia.....	5	Great Britain—Continued.	
Ecuador.....	1	British West Indies—Continued.	
France:		St. Kitts.....	1
French West Indies—		St. Vincent.....	1
Guadeloupe.....	1	Trinidad.....	2
Martinique.....	5	Italy.....	3
Germany.....	2	Nicaragua.....	1
Great Britain:		Panama.....	9
India.....	1	Peru.....	3
British West Indies—		Spain.....	2
Barbados.....	19	United States.....	3
Grenada.....	2		
Jamaica.....	14	Total.....	75

TABLE 24.—Ages of prisoners confined in penitentiary June 30, 1914.

Age.	Black.	White.	White, Ameri- can.	Total.
10 to 15 years.....	1			1
15 to 20 years.....	2	1		3
20 to 30 years.....	42	4		46
30 to 40 years.....	16	1	2	19
40 to 50 years.....	4			4
50 to 60 years.....		1		1
60 to 70 years.....	1			1
Total.....	66	7	2	75

Age of youngest prisoner.....	years..	14
Age of oldest prisoner.....	do....	66
Able to read and write.....	do....	48
Unable to read or write.....	do....	27

TABLE 25.—Causes of deaths investigated by the coroner during the fiscal year ended June 30, 1914.

Cause of death.	Number.	Cause of death.	Number.
Acute peritonitis.....	1	Perforation of small intestine.....	1
Asphyxiation.....	1	Poisoning, morphine.....	1
Disease of heart, organic.....	1	Railroad accidents.....	45
Drowning.....	1	Rupture of spleen.....	1
Drowning, accidental.....	50	Shooting, accidental.....	1
Electrocution, accidental.....	5	Suicide.....	5
Gangrene of leg.....	1	Traumatism, accidental.....	43
Hemorrhage.....	1	Traumatism, fracture of skull.....	3
Hemorrhage of brain.....	1	Unknown.....	2
Homicide.....	1		
Natural causes.....	2	Total.....	167

TABLE 26.—*Nationality of persons whose deaths were investigated by the coroner during the fiscal year ended June 30, 1914.*

Nationality.	Number.	Nationality.	Number.
Chile.....	3	Greece.....	2
Colombia.....	5	Haiti.....	2
Cuba.....	1	Holland:	
Ecuador.....	2	Dutch West Indies—	
France:		Saba Island.....	1
French West Indies—		Italy.....	4
Guadeloupe.....	1	Nicaragua.....	1
Martinique.....	12	Panama.....	9
Great Britain:		Russia: Finland.....	1
England.....	1	Salvador.....	1
British Gulana.....	2	Spain.....	8
British West Indies—		Sweden.....	1
Antigua.....	2	Turkey: Armenia.....	1
Barbados.....	28	United States.....	17
Fortune Island.....	1	Unknown.....	5
Grenada.....	1		
Jamaica.....	41	Total.....	167
Montserrat.....	1		
Nevis Island.....	2		
St. Lucia.....	2		
St. Vincent.....	6		
Trinidad.....	3		

TABLE 27.—*Statement of accidents involving personal injury investigated during the fiscal year ended June 30, 1914.*

Nationality.	Number.	Nationality.	Number.
Chile.....	3	Great Britain—Continued.	
Colombia.....	8	British West Indies—Continued.	
Cuba.....	1	St. Vincent.....	8
Denmark:		Trinidad.....	9
Danish West Indies—St. Thomas...	1	Turks Island.....	1
Ecuador.....	2	Greece.....	3
France.....	1	Haiti.....	3
French West Indies:		Holland:	
Guadeloupe.....	3	Dutch West Indies—Saba Island....	1
Martinique.....	21	Italy.....	10
Great Britain:		Mexico.....	1
England.....	1	Norway.....	1
Ireland.....	1	Panama.....	24
British Gulana.....	2	Peru.....	2
British West Indies:		Portugal.....	1
Antigua.....	6	Russia—Finland.....	1
Barbados.....	96	Spain.....	24
Fortune Island.....	5	Sweden.....	1
Grenada.....	9	Turkey—Armenia.....	1
Jamaica.....	116	United States.....	56
Montserrat.....	8	Porto Rico.....	2
Nevis.....	3	Unknown.....	3
New Providence.....	1	Venezuela.....	1
St. Kitts.....	1		
St. Lucia.....	8	Total.....	450

Of the above cases, 307 were Isthmian Canal Commission and Panama Canal employees, 51 Panama Railroad Co. employees, 21 McClintic-Marshall Construction Co. employees, 4 American Bridge Co. employees, and 67 nonemployees.

APPENDIX IV—DIVISION OF SCHOOLS.

TABLE 28.—*Net monthly enrollment and average daily attendance.*

	White schools.		Colored schools.	
	Monthly enrollment.	Average daily attendance.	Monthly enrollment.	Average daily attendance.
1913.				
October.....	1,109	985.7	1,058	756.3
November.....	1,136	959.1	1,137	698.5
December.....	1,147	970.6	1,161	746.1
1914.				
January.....	1,194	961.6	1,300	748.8
February.....	1,211	955.9	1,361	722.1
March.....	1,237	956.3	1,421	710.7
April.....	1,259	891.1	1,456	653.6
May.....	1,266	836.3	1,484	557.2
June.....	1,270	789.5	1,492	531.5

TABLE 29.—*Total enrollment for the year, by schools.*

White schools:		Colored schools:	
Ancon high.....	55	Ancon.....	344
Empire high ¹	23	Paraíso.....	118
Gatun high.....	35	Cucaracha ³	40
Grades—		Culebra.....	178
Ancon.....	396	Empire.....	251
Corozal.....	169	Mandingo ⁴	65
Pedro Miguel.....	132	Gatun.....	147
Paraíso.....	46	Mount Hope.....	36
Culebra.....	51	Cristobal.....	418
Empire.....	267	Marajal ⁵	18
Las Cascadas.....	85		
Gatun.....	150	Total (gross).....	1,615
Cristobal.....	316	Total gross enrollment, all schools.....	3,351
Porto Bello ²	11		
Total (gross).....	1,736		

¹ Empire High School closed Feb. 20, 1914, and pupils transferred to Ancon.² Porto Bello school closed Apr. 24, 1914, and pupils transferred to Cristobal and Gatun.³ Cucaracha colored school closed May 29, 1914.⁴ Mandingo colored school closed Dec. 19, 1913.⁵ Marajal colored school closed Feb. 6, 1914.TABLE 30.—*Net enrollment by grades.*

	White.	Colored.	Total.
Grade I.....	250	505	765
Grade II.....	196	368	564
Grade III.....	161	297	458
Grade IV.....	167	177	344
Grade V.....	131	76	207
Grade VI.....	130	57	187
Grade VII.....	96	12	108
Grade VIII.....	62	.....	62
Grade IX.....	31	.....	31
Grade X.....	28	.....	28
Grade XI.....	8	.....	8
Grade XII.....	9	.....	9
Special (high school).....	1	.....	1
Total.....	1,270	1,492	2,762

TABLE 31.—Number of teachers employed.

	White schools.	Colored schools.	Total.
1913.			
October.....	45	25	70
November.....	46	25	71
December.....	46	25	71
1914.			
January.....	45	24	69
February.....	45	24	69
March.....	45	24	69
April.....	44	24	68
May.....	43	24	67
June.....	43	23	66

APPENDIX V.—BUSINESS TRANSACTED IN THE COURTS OF THE CANAL ZONE DURING THE FISCAL YEAR ENDED JUNE 30, 1914.

TABLE 32.—Supreme court.

	Criminal cases.	Civil cases.		Criminal cases.	Civil cases.
Pending July 1, 1913.....	1	6	Dismissed.....		4
Filed during year.....	2	20	Reinstated.....		1
Affirmed.....	2	12	Habeas corpus proceeding.....		1
Reversed.....	1	8	Pending June 30, 1914.....		
Withdrawn.....					

Number of sessions of court.....	24
Collections:	
Civil cases.....	\$168.00
Miscellaneous.....	10.95

TABLE 33.—First circuit court.

CRIMINAL CASES.

Months.	Cases filed.	Con-victed.	Ac-quitted.	Dis-mitted.	Total col-lections (fines).
1913.					
Cases pending July 1.....	1				
July.....	27	17	2		\$1.00
August.....	25	18	10	2	32.00
September.....	23	17	5	1	15.00
October.....	12	12	2	1	15.00
November.....	19	11	2	2	
December.....	21	17	2	1	20.00
1914.					
January.....	10	12	1	1	
February.....	26	19	3	1	35.00
March.....	16	15	4		49.00
April.....	8				
Total.....	188	138	31	9	167.00

Forfeitures.....	\$300.00
Cases pending May 1, 1914.....	10

CIVIL CASES.

Cases pending July 1, 1913.....	139
Cases filed.....	1427
Cases settled.....	1439
Cases pending May 1, 1914.....	127
Costs.....	\$297.50
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$898.84

¹ Including probate cases.

TABLE 34.—*Second circuit court.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Ac- quitted.	Dis- missed.	Total col- lections (fines).
1913.					
Cases pending July 1.....	2				
July.....	10	8	2		\$65.00
August.....	10	9	2		55.00
September.....	14	7	5	2	5.00
October.....	15	7	3		99.00
November.....	9	6	8	¹ 1	
December.....	8	5	2	1	
1914.					
January.....	12	5	1	3	15.00
February.....	9	7	2		25.00
March.....	9	11	1		105.00
April.....	10				
Total.....	108	65	26	7	369.00

¹ Forfeiture.

Forfeitures.....	\$1,060.00
Cases pending May 1, 1914.....	10

CIVIL CASES.

Cases pending July 1, 1913.....	¹ 31
Cases filed.....	¹ 128
Cases settled.....	¹ 141
Cases pending May 1, 1914.....	¹ 18
Costs.....	\$616.10
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$689.25

TABLE 35.—*Third circuit court.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Dis- missed.	Total col- lections (fines).
1913.					
Cases pending July 1.....	1				
July.....	22	10	2	¹ 4	
August.....	6	5	1	¹ 3	
September.....	10	6	2		\$10.00
October.....	15	9	1		77.50
November.....	8	7	5	2	350.00
December.....	10	8	2	2	
1914.					
January.....	7	3	2	4	
February.....	13	7	2		10.00
March.....	5	4	1	1	85.00
April.....	6			1	
Total.....	103	59	18	17	532.50

¹ Forfeiture.

Forfeitures.....	\$300.00
Cases pending May 1, 1914.....	9

CIVIL CASES.

Cases pending July 1, 1913.....	2 40
Cases filed.....	2 58
Cases settled.....	2 75
Cases pending May 1, 1914.....	2 23
Costs.....	\$280.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$1,041.13

¹ Including probate and insane cases.² Including probate cases.

TABLE 36.—*District court, division of Balboa.*

CRIMINAL CASES.

Months.	Cases filed.	Con-victed.	Acquit-ted.	Dis-missed.	For-feited.	Total col-lections (fines).
1914.						
Pending May 1.....	20					
May.....	40	30	7	1	1	\$105.00
June.....	8	9	12	2		
Total.....	68	39	19	3	1	105.00

Forfeitures.....	\$500.00
Cases pending June 30, 1914.....	6

CIVIL CASES.

Cases pending May 1, 1914.....	1 45
Cases filed.....	1 118
Cases settled.....	1 115
Cases pending June 30, 1914.....	1 48
Costs.....	\$76.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$166.95

TABLE 37.—*District court, division of Cristobal.*

CRIMINAL CASES.

Months.	Cases filed.	Con-victed.	Acquit-ted.	Dis-missed.	Total col-lections (fines).
1914.					
Pending May 1.....	9				
May.....	6	6	3	2	\$24.00
June.....	8	1	1	2	10.00
Total.....	23	7	4	4	34.00

Cases pending June 30, 1914.....	8
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CIVIL CASES.

Cases pending May 1, 1914.....	1 23
Cases filed.....	1 15
Cases settled.....	1 14
Cases pending June 30, 1914.....	1 24
Costs.....	\$36.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$101.75

TABLE 38.—*District court, district of Ancon.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1913.								
Pending July 1.....	1							
July.....	195	149	16	27	3	\$540.50		\$540.50
August.....	178	130	18	28	3	487.00		487.00
September.....	150	104	8	28	9	517.00	\$7.50	524.50
October.....	122	97	12	9	4	256.00	2.50	258.50
November.....	95	59	15	20	2	163.00		163.00
December.....	161	123	10	26	2	188.50	3.00	191.50
1914.								
January.....	181	143	14	16	8	453.00	3.00	456.00
February.....	201	156	11	26	4	434.00	6.65	440.65
March.....	177	143	23	11	4	346.50		346.50
Total.....	1,461	1,104	127	191	39	3,385.50	22.65	3,408.15

¹ Including probate cases.

Forfeitures..... \$25.00

CIVIL CASES.

Cases pending July 1, 1913..... 20
 Cases filed..... 66
 Cases settled..... 85
 Cases pending Apr. 1, 1914..... 1
 Costs..... \$84.70
 Miscellaneous..... \$0.25

TABLE 39.—*District court, district of Empire.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Total col- lections (fines).
1913.						
Pending July 1.....						
July.....	161	109	34	14	14	\$610.25
August.....	171	140	19	7	4	856.00
September.....	138	115	13	10	1	875.00
October.....	123	93	12	11	6	505.50
November.....	101	76	13	10	2	385.50
December.....	120	99	15	4	3	542.75
1914.						
January.....	104	68	23	13		635.50
February.....	95	68	11	10	6	334.00
March.....	104	73	19	11	1	207.00
Total.....	1,117	841	159	90	27	4,952.00

¹ 1 forfeiture.

Forfeitures..... \$10.00

CIVIL CASES.

Cases pending July 1, 1913..... 4
 Cases filed..... 325
 Cases settled..... 329
 Costs..... \$450.75

TABLE 40.—*District court, district of Cristobal.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1913.								
Pending July 1.....	2							
July.....	124	65	31	16	13	\$399.00		\$399.00
August.....	122	86	13	7	¹ 15	517.00		517.00
September.....	110	67	24	9	² 10	397.00		397.00
October.....	120	75	18	13	² 15	340.00		340.00
November.....	95	65	17	8	² 5	326.00		326.00
December.....	140	92	37	5	² 4	501.00	\$78.00	579.00
1914.								
January.....	135	93	23	6	² 13	344.00		344.00
February.....	130	86	27	13	7	358.00		358.00
March.....	100	65	24	5	6	196.00		196.00
Total.....	1,078	694	214	82	88	3,378.00	78.00	3,456.00

¹ 3 settled under sections 359 and 360, Code of Criminal Procedure of the Canal Zone.

² 1 settled under sections 359 and 360, Code of Criminal Procedure of the Canal Zone.

Forfeitures..... \$25.00

CIVIL CASES.

Cases pending July 1, 1913..... 11
 Cases filed..... 102
 Cases settled..... 113
 Costs..... \$130.53

TABLE 41.—Magistrate court, subdivision of Balboa.

CRIMINAL CASES.						
Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to district court.	Dis- missed.	Total col- lections (fines).
1914.						
Pending Apr. 1.....						
April.....	258	208	23	19	5	\$827.00
May.....	225	182	18	25	3	721.00
June.....	267	239	12	8	2	992.00
Total.....	750	629	53	52	10	2,540.00
CRIMINAL CASES.						
Forfeitures.....						\$55.00
Cases pending June 30, 1914.....						6
CIVIL CASES.						
Cases pending Apr. 1, 1914.....						1
Cases filed.....						56
Cases settled.....						48
Cases pending June 30, 1914.....						9
Costs.....						\$118.50

TABLE 42.—Magistrate court, subdivision of Cristobal.

CRIMINAL CASES.						
Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to district court.	Dis- missed.	Total c l- lections (fines).
1914.						
Pending Apr. 1.....						
April.....	120	76	26	5	9	\$262.00
May.....	122	86	24	8	5	368.00
June.....	146	114	22	7	4	375.00
Total.....	388	276	72	20	18	1,005.00
CRIMINAL CASES.						
Forfeitures.....						\$50.00
Cases pending June 30, 1914.....						2
CIVIL CASES.						
Cases filed.....						26
Cases settled.....						25
Cases pending June 30, 1914.....						1
Costs.....						\$70.20

APPENDIX VI.

Ordinance prohibiting the passage or presence of floating craft, except those belonging to the United States or the Panama Railroad, in that section of The Panama Canal known as Culebra Cut between Gamboa and Pedro Miguel Lock.

By authority of the President of the United States, as expressed in Executive order of July 25, 1910, the following rules and regulations are adopted by the Isthmian Canal Commission for the purpose of facilitating work of excavation and canal construction, and the same shall have the force and effect of law when approved by the Secretary of War.

SECTION 1. Without special permission in writing, signed by the chairman of the Isthmian Canal Commission, no owner, master, or operator of any floating craft of any kind or character whatsoever, except such as may belong to or be chartered by the United States or the Panama Railroad Company, shall cause or permit such craft to enter, navigate, or be present within that portion of The Panama Canal known as the Culebra Cut, which lies between Gamboa and Pedro Miguel Lock.

SEC. 2. For the better enforcement of these rules and regulations, the officers and agents of the United States and the assistant engineers, superintendents, and supervisors employed under them by the authority of the Isthmian Canal Commission, shall

have power and authority to arrest and take into custody, with or without process, any person or persons who may commit any of the acts or offenses prohibited by section 1 of these rules and regulations, or who may violate any of the provisions of the same.

SEC. 3. As ordered by the President of the United States, any person violating the provisions of these rules and regulations shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not to exceed five hundred dollars (\$500) or by imprisonment in the district jail for not more than six months, or by both such fine and imprisonment, in the discretion of the court.

Approved.

LINDLEY M. GARRISON,
Secretary of War.

OCTOBER 3, 1913.

Ordinance amending section 8 of Ordinance No. 24, "Providing for the licensing of chauffeurs for automobiles."

Be it enacted by the Isthmian Canal Commission, that section 8 of the ordinance adopted by the Isthmian Canal Commission at its 160th meeting, held on April 15, 1911, and approved by the Secretary of War on April 26, 1911, providing for the licensing of chauffeurs for automobiles, be, and the same hereby is, amended to read as follows:

"The head of the department of civil administration is authorized to revoke for cause any license issued under the authority of this ordinance."

Enacted by the Isthmian Canal Commission, February 3, 1914.

Approved by the Secretary of War, February 14, 1914.

APPENDIX I-2.

REPORT OF COST-KEEPING ACCOUNTANT, COST-KEEPING
BUREAU.

BALBOA HEIGHTS, *September 12, 1914.*

SIR: I have the honor to submit the following report for this office for the fiscal year 1914:

In addition to the duties enumerated in the last annual report, the accounting for the former central division and for the quartermaster's department was transferred to this office on October 1, 1913, and that for the electrical division on June 1, 1914. Cost accounts were established for the construction of the permanent buildings, the Cristobal coaling plant, and the gravel-reclaiming plant at Gamboa. The reduction of accounting work, due to the completion of some of the canal units, has been more than offset by the increase in the accounting for the terminals, the permanent town sites, the permanent buildings, the quartermaster's department, and the electrical division. At the close of the fiscal year all the cost accounting for The Panama Canal was done in this office, with the exception of that for the mechanical division, civil government, and health. Considerable work was done on a permanent accounting system for The Panama Canal, and since April, when the expert accountant employed for that purpose returned to the States, the writer has devoted most of his time to this work. The methods recommended by the expert accountant for general bookkeeping and for the shops were revised with the view of simplifying them and of reducing clerical cost. Accounting methods were provided for the electrical division, the division of municipal engineering, the division of canal transportation, and the accounts for the commissary were revised in order to show operating costs as well as profits. At the close of the fiscal year a general scheme had been adopted and approved, and only detailed accounts relating to the maintenance and operation of the canal remained to be established. This is being done as necessity develops.

At the close of the last fiscal year the monthly pay roll of this office was \$2,937.50 and the pay rolls of the employees transferred with the accounts of the central division and quartermaster's department amounted to \$975 per month, while the expenses for the month of June, 1914, were \$3,597.77.

EXHIBIT A—STATEMENT OF CONSTRUCTION EXPENDITURES TO
JUNE 30, 1914.

This exhibit shows the total amount expended to June 30, 1914, for the actual construction of the canal and auxiliary works, segregated by localities and by units of work, the direct cost (including

plant and equipment), and the proportion of general expenses chargeable thereto. The total cost by geographical divisions follows:

Location.	Division cost.		General expenses.		Total.	
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Including Gatun to the sea.....	\$53,809,881.33	27.71	\$4,189,360.62	24.44	\$57,999,241.95	27.44
Gatun to Pedro Miguel.....	80,896,961.47	41.67	8,300,685.72	48.45	89,197,647.19	42.21
Including Pedro Miguel to the sea.....	55,038,650.72	28.35	4,084,166.63	23.83	59,122,817.35	27.98
Miscellaneous items of construction.....	4,413,717.41	2.27	369,438.62	2.16	4,783,156.03	2.27
General expenses, June, 1914.....			192,208.82	1.12	192,208.82	.10
Total.....	194,159,210.93	100.00	17,135,860.41	100.00	211,295,071.34	100.00

Included under "Miscellaneous items of construction" are such projects as the aids to navigation, the power-transmission system, etc., which can not be charged to any of the geographical sections of the canal. The following table shows by periods the percentage of surcharge over construction cost which has resulted from apportioning the general expenses to the work:

Location.	To June 30, 1909.	Fiscal year—					Total.
		1910	1911	1912	1913	1914	
Including Gatun to the sea.....	13.34	8.07	6.74	6.70	5.63	11.46	7.79
Gatun to Pedro Miguel.....	12.30	9.54	7.78	7.07	6.49	13.24	10.26
Including Pedro Miguel to the sea.....	10.99	9.76	7.76	6.07	6.57	9.11	7.42
Miscellaneous items of construction.....			19.23	9.04	3.70	8.86	8.37
Average.....	12.27	9.08	7.36	6.61	6.24	11.12	8.73

The total construction cost to the end of the fiscal year 1914 for the various units of canal work (excluding general expenses) was:

Including Gatun to the sea:

Prism excavation—

Dry.....	\$1,311,313.81
Hydraulic.....	10,318.87
Dredging.....	8,244,904.42
Gatun Spillway.....	3,141,270.84
Gatun Dam.....	7,565,214.04
Gatun Locks.....	28,454,682.80
Gatun permanent power house.....	632,920.69
Gatun Mindi Levee.....	103,824.63
Colon Breakwater, west.....	3,468,283.43
Colon Breakwater, east.....	365,417.60
Trinidad River Dam.....	35,976.23
Terminal facilities—Cristobal.....	475,753.97

Total..... 53,809,881.33

Gatun to Pedro Miguel:

Prism excavation—

Dry.....	77,797,037.01
Hydraulic.....	286,964.90
Dredging.....	2,646,265.90

Gatun to Pedro Miguel—Continued.

Masonry.....	\$11, 467. 28
Clearing canal line without excavation.....	155, 226. 38
Total.....	80, 896, 961. 47

Including Pedro Miguel to the sea:

Prism excavation—	
Dry.....	3, 161, 148. 59
Hydraulic.....	1, 078, 529. 11
Dredging.....	10, 112, 660. 08
Pedro Miguel Dams.....	341, 627. 72
Pedro Miguel Locks.....	12, 316, 972. 06
Miraflores East Dam and Spillway.....	1, 012, 851. 11
Miraflores West Dam.....	905, 032. 29
Miraflores Locks.....	17, 785, 898. 48
Miraflores permanent power house.....	208, 609. 96
La Boca Locks and Dams (abandoned).....	565, 684. 33
Naos Island Breakwater.....	782, 157. 11
Rock and sand producing plants.....	32, 142. 13
Terminal facilities.....	6, 799, 622. 01
Total.....	55, 038, 650. 72

Miscellaneous:

Permanent town sites.....	654, 004. 83
Permanent buildings.....	1, 462, 570. 46
Aids to navigation.....	545, 820. 08
Power-transmission system.....	1, 751, 322. 04
Total.....	4, 413, 717. 41

Total construction expenses..... 194, 159, 210. 93

In last year's annual report there was published under Exhibit B tables giving detailed costs by months of dry excavation, masonry, and filling. Due to the completion of most of these projects and to credits given for material used during the construction period and returned to storehouse or diverted to other projects, the costs by months would be misleading and the tables are omitted. For the total quantities produced, the expenditures and unit costs for the year are shown in Exhibit A.

Dry excavation.—Within the limits of the former Culebra Division, there were excavated 3,122,702 cubic yards at a division cost of \$0.5661 per cubic yard. This low cost is due to large quantities of track and other material recovered when the work was completed, the value of which was credited to this account. Dry excavation was completed in this section and the total quantity removed since the American occupation has been 110,261,883 cubic yards at a division cost of \$0.7066 per cubic yard. In the section from Pedro Miguel to the sea, there were excavated 306,700 cubic yards at a division cost of \$0.5134 per cubic yard. This low cost is also due to large quantities of track and other material recovered when the work was completed, the value of which was credited to this account. Dry excavation was completed and the total quantity removed has been 4,819,969 cubic yards at a division cost of \$0.6755 per cubic yard.

In the basin below the Miraflores Spillway, there were excavated during this fiscal year 107,728 cubic yards at a division cost of \$0.7085 per cubic yard, and in the channel south of the spillway, 26,338 cubic yards at a division cost of \$0.6974 per cubic yard.

Masonry.—At Gatun Spillway there were laid during this fiscal year 7,047 cubic yards of concrete, of which 6,275 cubic yards were plain concrete, at a division cost of \$7.8856 per cubic yard, and 772 cubic yards were reinforced concrete at a division cost of \$17.1495 per cubic yard. The masonry work is completed and 231,179 cubic yards of concrete were used in its construction, of which 228,723 cubic yards were plain concrete at a division cost of \$7.4440 per cubic yard, and 2,456 cubic yards were reinforced concrete at a division cost of \$15.2567 per cubic yard, an average division cost of \$7.5273 per cubic yard for the concrete in the structure.

At Gatun there were laid during the fiscal year 525 cubic yards of concrete in the lock structure, of which 398 cubic yards were plain concrete at a division cost of \$95.3944 per cubic yard, and 127 cubic yards were reinforced concrete at a division cost of \$94.6605 per cubic yard. Included in this cost is the expense of finishing, caulking, and chipping to grade the concrete laid in previous years, so that the average cost does not represent the actual cost of concrete laid during the year. The masonry work is completed and 2,041,240 cubic yards of concrete were used in the construction of these locks, of which 1,945,487 cubic yards were plain concrete, at a division cost of \$6.9252 per cubic yard, and 95,753 cubic yards were reinforced concrete at a division cost of \$11.6282 per cubic yard, an average division cost of \$7.1447 per cubic yard for concrete in the structure.

In addition to the above, there were laid during the fiscal year, in connection with the installation of the lock operating machinery, 9,785 cubic yards of concrete at a division cost of \$10.7015 per cubic yard, and in the construction of the control house, 94 cubic yards of reinforced concrete at a division cost of \$81.2796 per cubic yard. This building is completed, 662 cubic yards of reinforced concrete having been used in its construction, at a division cost of \$34.8448 per cubic yard.

At Pedro Miguel there were laid during the fiscal year, 1,087 cubic yards of concrete in the lock structure, of which 1,069 cubic yards were plain concrete at a division cost of \$20.5579 per cubic yard, and 18 cubic yards were reinforced concrete, at a division cost of \$128.7350 per cubic yard. Included in this cost is the expense of finishing, caulking, and chipping to grade the concrete laid in previous years, so that the average cost does not represent the actual cost of concrete laid during the year. The masonry work is completed and 907,175 cubic yards of concrete were used in the construction of these locks, of which 839,398 cubic yards were plain concrete at a division cost of \$5.2485 per cubic yard, and 67,777 cubic yards were reinforced concrete at a division cost of \$8.8655 per cubic yard, an average division cost of \$5.5188 per cubic yard for the concrete in the structure.

In addition to the above, there were laid during this fiscal year, in connection with the installation of the lock operating machinery, 10,961 cubic yards of concrete at a division cost of \$11.1332 per cubic yard, and in the construction of the control house, 592 cubic yards at a division cost of \$62.5423 per cubic yard. This building is completed, 797 cubic yards of reinforced concrete having been used in its construction at a division cost of \$56.7082 per cubic yard.

At Miraflores Spillway there were laid during the fiscal year, 10,112 cubic yards of concrete, of which 9,570 cubic yards were plain

concrete, at a division cost of \$8.3510 per cubic yard, and 542 cubic yards were reinforced concrete at a division cost of \$11.8730 per cubic yard. The masonry work is completed and 74,254 cubic yards of concrete were used in the construction of this spillway, of which 73,277 cubic yards were plain concrete, at a division cost of \$6.0946 per cubic yard, and 977 cubic yards were reinforced concrete, at a division cost of \$15.3238 per cubic yard, an average division cost of \$6.2160 per cubic yard for the concrete in the structure.

At Miraflores there were laid during the fiscal year 2,844 cubic yards of concrete in the locks structure, of which 2,218 cubic yards were plain concrete, at a division cost of \$20.48 per cubic yard and 626 cubic yards were reinforced concrete at a division cost of \$21.3088 per cubic yard. Included in the cost is the expense of finishing, caulking, and chipping to grade the concrete laid in previous years, so that the average cost does not represent the actual cost of concrete laid during the year. The masonry work is completed and 1,479,739 cubic yards of concrete were used in the construction of these locks, of which 1,408,484 cubic yards were plain concrete at a division cost of \$4.7596, and 71,255 cubic yards were reinforced concrete at a division cost of \$10.8431, an average division cost of \$5.0525 per cubic yard for the concrete in the structure.

In addition to the above, there were laid during the fiscal year, in connection with the installation of the lock operating machinery, 18,241 cubic yards of concrete at a division cost of \$11.3685 per cubic yard, and in the construction of the control house, 949 cubic yards, at a division cost of \$57.2407 per cubic yard.

Dry filling.—At the Gatun spillway, 25,467 cubic yards of back fill were placed during the year, at a division cost of \$0.5413 per cubic yard, completing the back fill at that point. A total of 50,183 cubic yards have been placed since the inception of the work, at a division cost of \$0.4969 per cubic yard. In the Gatun Dam 314,160 cubic yards of dry filling were placed during the year, at a division cost of \$0.4033 per cubic yard. In the construction of this dam 12,229,104 cubic yards of dry filling were placed, at a division cost of \$0.3950 per cubic yard, and 10,728,965 cubic yards of hydraulic filling, at a division cost of \$0.2768 per cubic yard. The total amount of material entering into the construction of the dam was, therefore, 22,958,069 cubic yards. At the Gatun Locks 91,576 cubic yards of back fill were placed behind the side walls during the year, at a division cost of \$1.4304 per cubic yard. This cost includes surfacing sections previously completed. The total quantity of back filling placed behind the side walls is 2,119,406 cubic yards, at a division cost of \$0.5007 per cubic yard. There was placed during this year in the Gatun Mindi Levee 113,031 cubic yards of dry fill, at a division cost of \$0.3413 per cubic yard, completing the work. This levee contains 290,189 cubic yards of dry fill, at a division cost of \$0.3463 per cubic yard, and 20,398 cubic yards of hydraulic fill, at a division cost of \$0.1631 per cubic yard. In the Pedro Miguel Dam 2,960 cubic yards of dry fill were placed, at a division cost of \$1.1242. This work was completed, and since its inception 699,518 cubic yards have been placed, at a division cost of \$0.4500 per cubic yard. At the Pedro Miguel Locks 27,750 cubic yards of back fill were placed, at a division cost of \$1.1146 per cubic yard, completing the work. The total amount of back fill placed since the inception of the work aggregates

834,288 cubic yards, at a division cost of \$0.4131 per cubic yard. In the center wall 5,619 cubic yards of filling were placed, at a division cost of \$1.6139 per cubic yard, completing the work, making a total since the inception of the work of 220,768 cubic yards, at a division cost of \$0.4777 per cubic yard. In the Miraflores west dam 98,424 cubic yards of dry filling were placed, at a division cost of \$0.6431 per cubic yard, completing the work. The total amount of dry filling used in the construction of this dam was 1,758,423 cubic yards, at a division cost of \$0.4582 per cubic yard. At the Miraflores Locks 360,198 cubic yards of back fill were placed behind the side walls, at a division cost of \$0.6021 per cubic yard, completing the work. The total amount of back fill placed at this point has been 2,366,252 cubic yards, at a division cost of \$0.3855 per cubic yard. In the center wall 92,244 cubic yards of filling were placed, at a division cost of \$0.5273 per cubic yard, completing the work, making a total since the inception of the work of 249,457 cubic yards, at a division cost of \$0.5846 per cubic yard.

EXHIBIT B—DETAILED COST PER UNIT OF WORK.

TABLE NO. 1—DREDGING EXCAVATION.

The quantities dredged in the canal prism by classes of dredges in the various sections of the canal and the division cost per cubic yard for operation and repairs was:

Class of dredge.	Miraflores entrance.		Gatun Lake.		Culebra Cut.		Miraflores Lake.		Pacific entrance.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Seagoing suction.....	2,343,013	\$0.0774	178,821	\$0.0755	.....	.....	.....	.....	1,787,302	\$0.0444
5-yard dipper.....	103,369	.3747	.....	.....	1,145,056	\$0.1822	.....	.....	96,360	.3857
10-yard dipper.....	.....	.....	.....	.....	334,001	.2703	.....	.....	.....	.....
French ladder.....	140,961	.2412	.....	.....	506,886	.2852	.....	.....	607,077	.1783
3-yard ladder.....	.....	.....	.....	.....	649,083	.2501	.....	.....	678,516	.1146
Pipe-line suction.....	1,118,694	.0969	382,348	.1574	797,337	.1590	159,817	\$0.2024	.....	.....
Total.....	3,706,037	.0991	561,169	.1313	3,432,363	.2134	159,817	.2024	3,169,255	.0955

The division cost for disposing of the material excavated by the various classes of dredges was: At the Atlantic entrance, ladder and dipper dredges, \$0.1604 per cubic yard; pipe-line dredges, \$0.0164 per cubic yard. In Gatun Lake, pipe-line dredges, \$0.0237 per cubic yard. In Culebra Cut, ladder and dipper dredges, \$0.1876 per cubic yard; pipe-line dredges, \$0.1107 per cubic yard. In Miraflores Lake, pipe-line dredges, \$0.0171 per cubic yard. At the Pacific entrance, ladder and dipper dredges, \$0.2520 per cubic yard. The sea-going suction dredges carry their excavation to the dumping ground, and the time consumed in the work is included in the dredging cost. Of the material dredged, 3,853,099 cubic yards were classified as rock, being by sections of the canal as follows: Atlantic entrance, 153,959 cubic yards; Culebra Cut, 2,512,708 cubic yards; Pacific entrance, 1,186,432 cubic yards. Some of this rock was dredged without breaking, but based on the total rock excavated, the division cost per cubic yard for drilling, blasting, and breaking was, by sections, as

follows: Culebra Cut, \$0.0316; Pacific entrance, \$0.1374. Other expenses, such as the operation of small boats, miscellaneous equipment, arbitraries for plant, etc., were, by sections, as follows: Atlantic entrance, \$0.0589 per cubic yard; Gatun Lake, \$0.1092 per cubic yard; Culebra Cut, \$0.1192 per cubic yard; Miraflores Lake, \$0.0984 per cubic yard; Pacific entrance, \$0.0416 per cubic yard.

The total division cost per cubic yard of dredging in the various sections was: Atlantic entrance, \$0.1589; Gatun Lake, \$0.2567; Culebra Cut, \$0.5195; Miraflores Lake, \$0.3179; Pacific entrance, \$0.2547.

Supplementary cost sheets were kept for dredging expenses at Cucaracha slide, from which there were removed 2,422,375 cubic yards of rock and earth at a division cost of \$0.4730 per cubic yard.

TABLE NO. 2—HYDRAULIC EXCAVATION.

There were removed during the fiscal year by the hydraulic excavation plant at Gold Hill, 1,384,455 cubic yards at a division cost of \$0.1997 per cubic yard, as against 57,274 cubic yards during the last fiscal year, at a division cost of \$0.1835 per cubic yard, the plant having started operation on June 16, 1913.

TABLE NO. 3—COLON WEST BREAKWATER.

During the fiscal year just ended there were placed in this breakwater 207,654 cubic yards of large rock, at a division cost of \$5.3267 per cubic yard, as against 183,762 cubic yards last year, at a division cost of \$4.8787 per cubic yard. This yardage is the volume of rock in the bank as it was ascertained by measuring the tonnage displacement of the barges in which the rock was transported. The increased division cost of \$0.4480 per cubic yard is due to increased charge for arbitraries for plant, the actual quantity of large rock used having been less than had been estimated.

In the Naos Island Breakwater there were placed 652,587 cubic yards of material, at a division cost of \$0.6088 per cubic yard, against 653,137 cubic yards last year, at a division cost of \$0.2934 per cubic yard. The increased cost is due to charging to this work last year only the cost of dumping and of maintaining the trestle, the material being excavation from the Culebra Cut, and all other charges being charged to "dry excavation." With the completion of excavation in the Cut, it was necessary to borrow for material from Sosa Hill, and some material was secured from the excavation in the site of the dry dock at Balboa. The expense of quarrying at Sosa Hill and of transporting the material to the breakwater accounts for the increased cost.

TABLE NO. 4—STONE PRODUCTION.

The Ancon quarry produced 502,798 cubic yards of crushed stone this year, at a cost of \$0.8974 per cubic yard, against 688,301 cubic yards last year at a cost of \$0.7795 per cubic yard. With a decrease in the quantity produced of 185,503 cubic yards, there was an increase in the cost per cubic yard of \$0.1179, principally in the operation of and repairs to the crushers.

TABLE NO. 5—SAND PRODUCTION.

There was dredged from Chame Point 199,319 cubic yards of sand, which cost, delivered in the storage piles, \$0.8265 per cubic yard, while 445,658 cubic yards were dredged last year and the cost was \$0.7111 per cubic yard, a decrease in quantity of 246,339 cubic yards and an increase in cost per cubic yard of \$0.1154, being principally in the expense of dredging and of transporting from Chame to Balboa.

EXHIBIT C—DETAILED COST TO JUNE 30, 1914.

These tables show the cost to date of the following projects:

TABLE NO. 1—SPILLWAY GATES, CAISSONS AND MACHINERY, LOCK GATES AND FENDER CHAINS, EMERGENCY DAMS, HYDROELECTRIC POWER PLANT.

The spillway gates were completed during the year, at a total division cost of \$84,353.79 for those at Gatun and \$42,420.72 for those at Miraflores. The spillway caissons cost, respectively, \$6,325.31 for that for Gatun and \$5,799.05 for that for Miraflores. The operating machinery for the gates cost \$103,131.63 at Gatun and \$107,622.95 at Miraflores.

The cost of the lock gates to date was \$2,791,563.49 at Gatun, \$1,782,993.97 at Pedro Miguel, and \$1,897,249.53 at Miraflores. Included in the cost of the gates at Pedro Miguel is the value of spare parts received under the contract, which will be credited to the work and charged to material on hand as soon as satisfactory check can be made of the parts turned over to the supply department for storage.

There has been expended on the fender chains to date \$7,145.08 at Gatun, \$6,401.36 at Pedro Miguel, and \$266.68 at Miraflores for inspection, testing, and installation of chains now being received.

The cost of the emergency dams to date has been \$761,838.62 at Gatun, \$807,843.06 at Pedro Miguel, and \$637,302.99 at Miraflores.

There has been expended to the end of this fiscal year on the hydroelectric power plant at Gatun, \$628,712.68, of which \$328,457.08 was for the buildings and \$300,255.60 for the machinery and its installation.

TABLE NO. 2—LOCK-OPERATING MACHINERY.

There has been expended to date for inspection of operating machinery, etc., \$75,129.47 for that at Gatun, \$33,654.64 for that at Pedro Miguel, and \$59,141.95 for that at Miraflores. There has been erected the following miter-gate machinery at the various locks: At Gatun, 40 miter gate-moving machines at an average cost of \$9,224.93 per machine, 20 miter forcing machines at an average cost of \$1,257.98 per machine, 40 hand rail machines at an average cost of \$279.59 per machine, and 40 gate sump pumps at an average cost of \$273.27 per machine. The installation of the electrical apparatus to operate these machines cost \$93,387.97, making a total cost for the miter-gate machines of \$509,659.47. At Pedro Miguel, 24 miter gate-moving machines at an average cost of \$8,908.20 per machine, 12 miter forcing machines at an average cost of \$1,186.88 per machine, 24 hand-rail machines at an average cost of \$187.89 per machine, 24 gate sump pumps at an average cost of \$253.66 per machine. The installation of the electrical apparatus to operate

these machines cost \$42,876.37, making a total cost for the miter-gate machines of \$281,512.81. At Miraflores, 28 miter gate-moving machines at an average cost of \$8,557.71 per machine, 14 miter forcing machines at an average cost of \$1,271.30 per machine, 28 hand-rail machines at an average cost of \$498.54 per machine, 28 gate sump pumps at an average cost of \$410.63 per machine. The installation of the electrical apparatus to operate these machines cost \$71,389.08, making a total cost for the miter gate machines of \$354,259.96.

There has been installed at Gatun 62 rising stem valves at an average cost of \$2,996.84 each, and 62 machines to operate them at an average cost of \$8,074.21 per machine. At Pedro Miguel, 30 rising stem valves at an average cost of \$3,350.68 each and 30 machines to operate them at an average cost of \$7,646.20 per machine. At Miraflores, 42 rising stem valves at an average cost of \$3,852.57 each and 42 machines to operate them at an average cost of \$7,871.81 per machine. The above costs include the electrical installation.

In adjusting the cylindrical valves which were put in by the construction divisions, there was expended at Gatun an average of \$119.62 per valve, at Pedro Miguel, \$165.68 per valve, and at Miraflores, \$281.74 per valve. Sixty machines to operate these valves were installed at Gatun at an average cost of \$1,718.47 per machine, 20 at Pedro Miguel at an average cost of \$2,018.48 per machine, and 40 at Miraflores at an average cost of \$1,574.60 per machine, including the electrical equipment to operate them.

At each of the locks there are four auxiliary culvert valve machines, and the cost per machine installed, including the electrical apparatus to operate them, was \$1,797.31 at Gatun, \$1,846.34 at Pedro Miguel, and \$2,057.78 at Miraflores.

The erection of the machines for operating the chain fenders was not completed at the close of this fiscal year. There are 16 of these machines at each lock and to date there has been expended an average of \$17,247.31 per machine at Gatun, \$16,662.36 at Pedro Miguel, and \$18,010.64 at Miraflores.

There is one culvert pump at each lock, and their cost, including the electrical machinery to operate them, has been \$3,441.26 at Gatun, \$5,685.18 at Pedro Miguel, and \$3,619.70 at Miraflores.

There are three drainage sump pumps at each lock, and their average cost has been \$535.63 per machine at Gatun, \$478.05 per machine at Pedro Miguel, and \$331.98 per machine at Miraflores.

To the close of the fiscal year, seven locomotives had been received, tested, and erected at Gatun at an average cost of \$14,873.74 per locomotive, eight at Pedro Miguel at an average cost of \$13,708.36 per locomotive, and six at Miraflores at an average cost of \$14,220.06 per locomotive. There has also been charged against the Gatun locks \$25,085.15, being the cost and expenses in connection with the test locomotive which was returned to the contractors.

There are 17 transformer rooms at Gatun, 9 at Pedro Miguel, and 13 at Miraflores, and the average cost per room of the equipment installed has been \$9,005.59, \$8,935.66, and \$9,526.63, respectively.

The cost of the equipment and installation in the high-tension switch chambers, of which there are two at each lock, has been, per chamber, \$2,013.70, \$1,780.51, and \$2,404.86 at Gatun, Pedro Miguel, and Miraflores, respectively.

There have been charged into the accounts for cost and installation of electric cables \$386,152.44 at Gatun, \$154,574.03 at Pedro Miguel, and \$288,422.29 at Miraflores. These figures are, however, subject to adjustment, as a redistribution is to be made of the cables used at the various locks and in the transmission duct lines.

For the towing-track system, 37,326 linear feet of track were laid at Gatun at an average cost of \$12.04 per linear foot, 24,010 linear feet at Pedro Miguel at an average cost of \$13.57 per linear foot, and 31,153 linear feet at Miraflores at an average cost of \$13.06 per linear foot. This includes electrical connections, the crossovers, and the bumping posts.

In the installation of the machinery, the track system, and decking at Gatun, 26,491 cubic yards of concrete have been placed at a division cost of \$12.4111 per cubic yard. At Pedro Miguel, 21,151 cubic yards at a division cost of \$11.6213 per cubic yard, and at Miraflores 28,055.25 cubic yards at a division cost of \$11.3449 per cubic yard.

TABLE NO. 3—TRANSMISSION SYSTEM.

There have been expended on surveys and testing, \$16,690.80 and in inspection \$18,191.36. To the close of the fiscal year, 815 span bridges have been erected at an average cost of \$917.77 per bridge. Forty-four and forty-six hundredths miles of the system have been wired at an average cost for wires and insulators of \$5,991.93 per mile. At Gatun, 14,239 linear feet of duct line were constructed at an average cost of \$5.53 per linear foot, at Pedro Miguel 11,012 linear feet at an average cost of \$8.39 per linear foot, and at Miraflores, 2,650 linear feet at an average cost of \$5.87 per linear foot. This cost does not include the cost of the cables drawn through the ducts.

To the close of the fiscal year there have been expended on the Cristobal Transformer substation, \$123,368.26, of which \$114,810.30 were for construction of the building and the remainder for equipment and its installation. On the Gatun substation, \$186,536.03 have been expended, of which \$145,717.92 were for the building and the remainder for equipment and its installation. At the Miraflores substation, \$155,532.20 have been expended, of which \$103,509.04 were for the building and the remainder for equipment and its installation, and at Balboa substation, \$49,173.84 have been expended, of which \$45,565.12 were for the building and the remainder for equipment and its installation. These substations were in various stages of completion at the close of the fiscal year.

The total amount expended on the transmission system to the close of this fiscal year was \$1,750,569.68.

TABLE NO. 4—AIDS TO NAVIGATION.

To the close of this fiscal year there have been expended on aids to navigation \$514,878.81.

TABLE NO. 5—CRISTOBAL TERMINALS.

To the close of the fiscal year there have been expended for the coaling plant at Cristobal \$390,789.31. Of this amount, \$33,650.56 were for preliminary work, such as designing, surveys, inspection,

and temporary tracks. Three hundred and ninety-five thousand and thirty-four cubic yards of material were dredged from the site of the coaling plant and its approaches at a division cost of \$0.6550. In preparing foundations, 82,105 linear feet of piling were driven at a division cost of \$0.3841 per linear foot, and 3,781 cubic yards of excavation were removed at a division cost of \$1.2260.

In the erection of fuel-oil tanks, \$49,694.15 have been expended, making a total division expenditure to date for Cristobal terminals of \$440,483.46.

TABLE NO. 6—BALBOA TERMINALS.

In preliminary work and in preparing site there have been expended to date \$1,108,773.31. Of this amount \$35,148.26 were expended on surveys, etc., \$435,446.97 in clearing the area occupied by the terminals, \$41,137.01 in the construction of a drainage culvert over the Curundu River. There have been excavated 418,562 cubic yards at a division cost of \$0.5864 per cubic yard, and 764,042 cubic yards of filling have been placed at a division cost of \$0.4092 per cubic yard. In dredging the inner harbor, 3,698,781 cubic yards of material were removed at a division cost of \$0.1177 per cubic yard; 2,912,411 cubic yards of this material were used in reclaiming swamp lands at a further cost of \$0.0542 per cubic yard. In the entrance basin, 388,118 cubic yards of material have been removed in the dry at a division cost of \$0.9946. There have been expended in the construction of the main dry dock \$504,320.59, including the cost of excavating 855,093 cubic yards of material from the dock area at a division cost of \$0.9946 per cubic yard. In the construction of Dry Dock No. 2, \$78,312.02 were expended, including cost of excavating 93,677 cubic yards in the dock area at a division cost of \$0.8129 per cubic yard. On the coaling plant, \$287,269.17 have been expended, including the cost of excavating 224,325 cubic yards of material at a division cost of \$0.8107 per cubic yard, and of placing 2,138 cubic yards of masonry in the retaining walls at a division cost of \$7.4811 per cubic yard, and of placing 1,816 cubic yards of backfill at a division cost of \$1.3994 per cubic yard. In the construction of the sea wall, \$126.85 have been expended. In the construction of the permanent shops, including the erection of the machinery therein, there have been expended to the end of the fiscal year \$2,444,462.23. In the construction of the docks, \$1,212,917.01 have been expended, of which \$41,704.31 were for preliminary work, \$421,200.57 for the quay wall north of the concrete dock, \$107,956.85 for the quay wall south of the concrete dock, \$130,306.14 on the bulkhead quay wall between the wharf and Pier No. 1 and \$511,749.14 on Pier No. 1. At the quay wall north of the concrete dock there have been excavated for and in the concrete piers 19,896 cubic yards at a division cost of \$2.2576 per cubic yard. In the construction of caisson shells for this dock, 6,464 cubic yards of concrete have been used at a division cost of \$13.0343 per cubic yard and 7,945 cubic yards of concrete were used in filling these caissons at a division cost of \$6.6675 per cubic yard. Three thousand eight hundred and thirty-two cubic yards have been removed in the excavation for the floor girders at a division cost of \$2.2520 per cubic yard. Seven thousand three hundred and fifty-nine cubic yards of concrete have been laid in the floor at a division cost of \$24.2281 per cubic yard and 75,683

square feet of brick pavement were laid at a division cost of \$0.3120 per square yard. At the quay wall south of the concrete dock, 25,720 cubic yards have been dredged at a division cost of \$0.4689 per cubic yard, in the excavation for and in the piers, 669 cubic yards of material were excavated at a division cost of \$2.2929 per cubic yard and in filling the caissons, 1,487 cubic yards of concrete were used at a division cost of \$9.3277 per cubic yard. At the bulkhead quay wall between the wharf and Pier No. 1, 7,835 cubic yards have been excavated for and in the concrete piers at a division cost of \$2.4612 per cubic yard. In the construction of the caisson shells, 1,657 cubic yards of concrete have been used at a division cost of \$5.9657 per cubic yard. In the excavation for the floor girders, 52 cubic yards of material have been removed at a division cost of \$31.3286 per cubic yard. In the construction of the floor, 2,462 cubic yards of concrete have been placed at a division cost of \$16.3920 per cubic yard. In the concrete balustrade, 21 cubic yards of concrete have been placed at a division cost of \$33.7429 per cubic yard. In back filling this structure, 2,313 cubic yards have been placed at a division cost of \$2.1406 per cubic yard. At Pier No. 1 there have been removed in the excavation for and in the concrete piers 31,666 cubic yards at a division cost of \$2.9495 per cubic yard. In the construction of the caisson shells, 10,773.5 cubic yards of concrete have been used at a division cost of \$12.5772 per cubic yard and 13,346 cubic yards of concrete have been placed in the caissons at a division cost of \$6.7139 per cubic yard. In the excavation for the floor girders, 7,373 cubic yards have been removed at a division cost of \$1.4920 per cubic yard. In the floor, 10,222 cubic yards of concrete have been placed at a division cost of \$16.1893 per cubic yard. In the back filling for this structure, 939 cubic yards have been placed at a division cost of \$1.9287 per cubic yard.

There have been expended in the construction of the fuel-oil-handling plant \$50,289.33, including the dredging of 60,776 cubic yards in the berth for the oil ships at a division cost of \$0.0983 per cubic yard.

TABLE NO. 7.—PERMANENT TOWN SITES.

There have been expended on the La Boca permanent town sites, which is the settlement for the silver employees of the canal, \$132,539.23; on the Balboa town site, \$409,116.35; and on the Pedro Miguel town site, \$112,349.25.

TABLE NO. 8.—PERMANENT BUILDINGS.

There have been expended under this head to the close of the fiscal year \$1,441,221.40, of which \$716,936.09 was for the administration building at Balboa, \$425,210.17 for twenty-eight 4-family apartments, \$20,737.76 for nine 2-family apartments. These buildings are of concrete construction and were in various stages of completion at the end of the fiscal year. In addition thereto, there have been expended on miscellaneous buildings, \$4,691.48; on employees' quarters at La Boca, \$157,230.29; at Balboa Heights, \$81,962.85; at Paraiso, \$1,447.73; and at Pedro Miguel, \$19,703.53. These latter buildings are of wooden construction and were erected with material secured from buildings in abandoned settlements.

TABLE NO. 9.—COST OF BUILDINGS ERECTED BY SUPPLY DEPARTMENT AND CHARGED TO OTHER UNITS OF CONSTRUCTION.

Comments on this table are included under the units of construction to which the buildings belong.

EXHIBIT D—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES FOR FISCAL YEAR 1913-14.

The total expenditures classed as administrative and general expenses and of overhead aggregated, for the fiscal year 1914, \$2,633,078.94, as against \$2,340,674.87 in 1913, an increase of \$292,404.07, or 12.5 per cent. The principal items of increase were: General expenses on the Isthmus, \$141,151.45. This increase is apparent only, being due to the consolidation in the executive office of the time keeping and cost keeping and of the institution of a records division. Miscellaneous expenses in the United States, \$10,001.69. This is accounted for by payment of salaries to the commission appointed by Congress to prepare for the official opening of the canal. Accounting on Isthmus, collector, \$5,556.90. This is due to the creation of the office of collector on April 1, 1914. Accounting in the United States, assistant auditor, \$10,789.49. This amount is partially offset by decrease of \$6,981.65 in the office of disbursing clerk, the balance being due to an increase in the force of the assistant auditor. Passenger transportation on Isthmus, \$8,909.28. This increase is due to there having been 13 monthly payments to the Panama Railroad Co. for passenger transportation included in this year's accounts, against 12 in the previous year. Operation of stores, \$147,131.61. This increase is due to charging the supply department with its proportion of the monthly payment made to the Panama Railroad Co. for transportation of freight and to expenses incurred in moving the storehouse from Gorgona to Empire and later from Empire to Balboa. Recruiting and repatriating, \$108,673.71. This increase is due to the large payments to the steamship companies for transportation of employees leaving the service.

The principal items of decrease are: Isthmian Canal Commission Band, \$8,765.99. The band was abolished in February, 1913, and no expense was incurred under that head this year. Accounting on Isthmus, auditor, \$7,585.37; paymaster, \$13,476.13. These decreases are due to the reorganization of the former examiner of accounts and disbursing officers' offices. Telegraph and telephones, \$29,116.99. This decrease is due to the reduction of the monthly payment to the Panama Railroad Co. for telephone service. Quarters, \$78,881.41. This decrease is due to the reduction in the number of employees in quarters.

Appended hereto are the exhibits referred to in this report.
Respectfully submitted.

AD. FAURE,
Cost-keeping Accountant.

Col. GEORGE W. GOETHALS, United States Army,
*Governor of The Panama Canal,
Balboa Heights, Canal Zone.*

EXHIBITS SUBMITTED WITH ANNUAL REPORT OF COST-KEEPING ACCOUNTANT.

INDEX.

	Page.
Exhibit A. Statement of construction expenditures to June 30, 1914.....	456
Table No. 1. Construction of canal from and including Gatun to the sea..	456
Table No. 2. Construction of canal from Gatun to Pedro Miguel.....	464
Table No. 3. Construction of canal from and including Pedro Miguel to the sea.....	465
Table No. 4. Miscellaneous.....	475
Exhibit B. Detailed cost per unit of work by months, fiscal year 1914.....	477
Table 1. Dredging.....	477
A. Atlantic entrance	477
B. Gatun Lake.....	479
C. Culebra Cut	480
D. Miraflores Lake.....	482
E. Pacific entrance.....	483
Table 2. Hydraulic excavation.....	485
Table 3. Colon Breakwater.....	485
Table 4. Stone production.....	487
Table 5. Sand production.....	488
Exhibit C. Detailed cost of work done to June 30, 1914.....	490
Table 1. Spillway gates and machinery, lock gates, emergency dams, chain fenders, and hydroelectric power plant.....	490
Table 2. Locks operating machinery.....	491
Table 3. Transmission system.....	494
Table 4. Aids to navigation.....	495
Table 5. Terminal facilities, Cristobal.....	496
Table 6. Terminal facilities, Balboa.....	498
Table 7. Permanent town sites.....	504
Table 8. Permanent buildings.....	504
Table 9. Permanent buildings charged to other units of construction.....	506
Exhibit D. Comparative statement of administrative and general expenses...	509

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914.

TABLE No. 1.—*Construction of canal from and including Gatun to the sea.*

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation—prism:							
May 4, 1904, to June 30, 1909.....	<i>Cu. yds.</i> 1,152,105	\$674,083.94	\$0.5851	\$104,526.28	\$0.0907	\$778,610.22	\$0.6758
Fiscal year 1910.....	324,716	201,916.36	.6218	24,985.55	.0770	226,901.91	.6988
Fiscal year 1911.....	280,305	168,440.60	.6010	13,946.79	.0497	182,387.39	.6507
Fiscal year 1912.....	424,872	252,886.45	.5952	17,265.97	.0406	270,152.42	.6358
Fiscal year 1913.....		13,910.16				13,910.16	
Fiscal year 1914.....		76.30				76.30	
Total to June 30, 1914.....	2,181,998	1,311,313.81	.6010	160,724.59	.0736	1,472,038.40	.6746
Hydraulic excavation—prism:							
Fiscal year 1911.....	28,605	7,721.28	.2699	1,143.49	.0400	8,864.77	.3099
Fiscal year 1912.....	1,000	2,597.59	2.5976	208.96	.2090	2,806.55	2.8066
Total to June 30, 1914.....	29,605	10,318.87	.3485	1,352.45	.0457	11,671.32	.3942

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE No. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dredging excavation—prism:							
May 4, 1904, to June 30, 1909.....	<i>Cu. yds.</i> 13,188,123	\$2,657,486.10	\$0.2015	\$283,319.01	\$0.0215	\$2,940,805.11	\$0.2230
Fiscal year 1910.....	4,955,660	1,169,667.60	.2360	131,370.17	.0265	1,301,037.77	.2625
Fiscal year 1911.....	5,828,345	1,291,257.03	.2215	126,902.35	.0218	1,418,159.38	.2433
Fiscal year 1912.....	4,870,827	1,208,226.15	.2481	100,928.48	.0207	1,309,154.63	.2688
Fiscal year 1913.....	6,483,408	1,356,771.78	.2093	108,556.23	.0167	1,465,328.01	.2260
Fiscal year 1914.....	3,706,037	588,562.97	.1589	52,523.95	.0142	641,086.92	.1731
Total to June 30, 1914.....	39,032,400	8,271,971.63	.2119	803,600.19	.0206	9,075,571.82	.2325
Plant overcharge, to be adjusted on completion of work.....		27,067.21				27,067.21	
Total.....		8,244,904.42		803,600.19		9,048,504.61	
GATUN SPILLWAY.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	1,296,332	779,653.49	.6014	130,836.44	.1009	910,489.93	.7023
Fiscal year 1910.....	122,487	117,945.47	.9629	15,460.31	.1262	133,405.78	1.0891
Fiscal year 1911.....	125,333	51,014.89	.4060	5,890.34	.0470	56,905.23	.4539
Fiscal year 1914.....		301.19		59.54		360.73	
Total to June 30, 1914.....	1,544,202	948,915.04	.6145	152,246.63	.0986	1,101,161.67	.7131
Preparing foundations:							
Fiscal year 1910.....	4,723	18,632.78	3.9451	2,732.07	.5785	21,364.85	4.5236
Fiscal year 1911.....	32,245	48,521.10	1.5048	5,893.94	.1828	54,415.04	1.6876
Fiscal year 1912.....	7,123	18,804.83	2.6400	1,882.79	.2643	20,687.62	2.9043
Fiscal year 1913.....	175	418.48	2.3913	132.54	.7574	551.02	3.1487
Fiscal year 1914.....	449	1,519.80	3.3848	219.55	.4890	1,739.35	3.8738
Total to June 30, 1914.....	44,715	87,896.99	1.9657	10,860.89	.2429	98,757.88	2.2086
Masonry:							
Concrete, plain—							
May 4, 1904, to June 30, 1909.....	30,464	223,203.73	7.3268	20,565.26	.6751	243,768.99	8.0019
Fiscal year 1910.....	53,632	461,338.27	8.6019	27,380.14	.5105	488,718.41	9.1124
Fiscal year 1911.....	59,651	399,925.98	6.7044	16,875.75	.2829	416,801.73	6.9873
Fiscal year 1912.....	58,048	407,108.10	7.0133	23,825.55	.4105	430,933.65	7.4238
Fiscal year 1913.....	20,653	161,556.53	7.8224	17,838.63	.8637	179,395.16	8.6861
Fiscal year 1914.....	6,275	49,482.58	7.8856	5,041.55	.8035	54,524.13	8.6891
Total to June 30, 1914.....	228,723	1,702,615.19	7.4440	111,527.18	.4876	1,814,142.37	7.9316
Concrete, reinforced—							
Fiscal year 1912.....	618	9,370.80	15.1631	704.30	1.1396	10,075.10	16.3027
Fiscal year 1913.....	1,066	14,860.14	13.9401	2,033.54	1.9076	16,893.68	15.8477
Fiscal year 1914.....	772	13,239.41	17.1495	859.16	1.1128	14,098.57	18.2623
Total to June 30, 1914.....	2,456	37,470.35	15.2567	3,597.00	1.4645	41,067.35	16.7212
Total masonry.....	231,179	1,740,085.54	7.5273	115,124.18	.4980	1,855,209.72	8.0253
Ironwork:							
Fiscal year 1910.....		346.26		41.60		387.86	
Fiscal year 1911.....		16,869.54		2,573.79		19,443.33	
Fiscal year 1912.....		80,153.39		14,133.29		94,286.68	
Fiscal year 1913.....		33,921.54		6,996.03		40,917.57	
Fiscal year 1914.....		14,327.89		1,386.13		15,714.02	
Total to June 30, 1914.....		145,618.62		25,130.84		170,749.46	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE, 30 1914—Continued.

TABLE NO. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN SPILLWAY—contd.							
Gates:	<i>Cu. yds.</i>						
Fiscal year 1912.....		\$29,981.71				\$29,981.71	
Fiscal year 1913.....		43,750.51		\$2,738.61		46,489.12	
Fiscal year 1914.....		16,955.61		2,354.84		19,310.45	
Total to June 30, 1914.....		90,687.83		5,093.45		95,781.28	
Operating machinery:							
Fiscal year 1913.....		91,122.95		1,641.34		92,764.29	
Fiscal year 1914.....		12,008.68		2,059.85		14,068.53	
Total to June 30, 1914.....		103,131.63		3,701.19		106,832.82	
Back filling:							
Fiscal year 1910.....	1,781	1,005.69	\$0.5647	93.55	\$0.0525	1,099.24	\$0.6173
Fiscal year 1911.....	12,873	6,220.54	.4832	773.45	.0601	6,993.99	.5433
Fiscal year 1912.....	10,062	3,921.88	.3898	441.07	.0438	4,362.95	.4336
Fiscal year 1914.....	25,467	13,787.08	.5413	3,564.09	.1399	17,351.17	.6812
Total to June 30, 1914.....	50,183	24,935.19	.4969	4,872.16	.0971	29,807.35	.5940
Total Gatun Spillway.....		3,141,270.84		317,029.34		3,458,300.18	
GATUN DAM.							
Dredging excavation—May 4, 1904, to June 30, 1909.....	38,425	18,322.71	.4769	1,718.48	.0447	20,041.19	.5216
Dry filling:							
May 4, 1904, to June 30, 1909.....	2,244,622	928,458.86	.4137	184,820.53	.0824	1,113,279.39	.4961
Fiscal year 1910.....	2,555,197	757,828.15	.2966	87,078.24	.0340	844,906.39	.3306
Fiscal year 1911.....	2,675,945	1,018,351.43	.3806	76,382.58	.0285	1,094,734.01	.4091
Fiscal year 1912.....	2,626,447	1,356,471.78	.5165	94,331.18	.0359	1,450,802.96	.5524
Fiscal year 1913.....	1,812,733	643,726.42	.3551	56,392.04	.0311	700,118.46	.3862
Fiscal year 1914.....	314,160	126,708.63	.4033	18,685.25	.0595	145,393.88	.4628
Total to June 30, 1914.....	12,229,104	4,831,545.27	.3950	517,689.82	.0424	5,349,235.09	.4374
Hydraulic filling:							
May 4, 1904, to June 30, 1909.....	720,047	162,553.19	.2258	34,540.85	.0479	197,094.04	.2737
Fiscal year 1910.....	2,933,175	786,641.96	.2682	59,910.57	.0204	846,552.53	.2886
Fiscal year 1911.....	4,256,393	974,230.44	.2289	77,572.23	.0182	1,051,802.67	.2471
Fiscal year 1912.....	2,604,632	1,001,405.34	.3844	52,407.82	.0201	1,053,813.16	.4045
Fiscal year 1913.....	214,718	44,885.52	.2090	9,521.55	.0444	54,407.07	.2534
Fiscal year 1914.....		1,109.89		7.78		1,102.11	
Total to June 30, 1914.....	10,728,965	2,968,606.56	.2768	233,960.80	.0218	3,202,567.36	.2986
Paving:							
Excavation—fiscal year 1913.....	15,078	31,704.98	2.1027	3,850.80	.2554	35,555.78	2.3581
Placing riprap—							
Fiscal year 1913....	68,730	45,181.42	.6574	2,204.24	.0320	47,385.66	.6894
Fiscal year 1914....	9,860	20,117.73	2.0403	431.55	.0438	20,549.28	2.0841
Total to June 30, 1914.....	78,590	65,299.15	.8309	2,635.79	.0335	67,934.94	.8644

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE No. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN DAM—continued.							
Paving—Continued.							
Placing broken stone—fiscal year 1913....	<i>Cu. yds.</i> 15,740	\$38,620.09	\$2.4536	\$2,032.83	\$0.1292	\$40,652.92	\$2.5828
Total paving.....	94,330	135,624.22	1.4378	8,519.42	.0903	144,143.64	1.5281
Surfacing (square yards):							
Fiscal year 1913.....	225,460	4,756.90	.0211	570.40	.0025	5,327.30	.0236
Fiscal year 1914.....	164,605	15,121.29	.0919	2,360.12	.0143	17,481.41	.1062
Total to June 30, 1914.....	390,065	19,878.19	.0510	2,930.52	.0075	22,808.71	.0585
Permanent tracks, fiscal year 1914.....		5,993.31		487.91		6,481.22	
Total, Gatun Dam.....		7,979,970.26		765,306.95		8,745,277.21	
East saddle dam: Dry fill, fiscal year 1914.....	4,117	1,687.85	.4100	116.04	.0282	1,803.89	.4382
Total, Gatun Dams and Spillway.....		11,122,928.95		1,082,452.33		12,205,381.28	
Plant: Overcharge to construction to be adjusted on completion of work.....		416,444.07				416,444.07	
Total.....		10,706,484.88		1,082,452.33		11,788,937.21	
GATUN LOCKS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	3,240,218	1,730,982.15	.5344	224,468.32	.0693	1,955,450.47	.6037
Fiscal year 1910.....	839,302	687,602.40	.8193	73,991.47	.0881	761,593.87	.9074
Fiscal year 1911.....	475,875	338,332.43	.7110	37,019.15	.0778	375,351.58	.7888
Fiscal year 1912.....		3,337.87				3,337.87	
Fiscal year 1913.....	104,660	63,229.86	.6041	4,987.33	.0477	68,217.19	.6518
Total to June 30, 1914.....	4,660,055	2,816,808.97	.6045	340,466.27	.0731	3,157,275.24	.6776
Dredging excavation:							
May 4, 1904, to June 30, 1909.....	488,533	79,978.65	.1637	9,427.51	.0193	89,406.16	.1830
Fiscal year 1911.....		2,999.32		305.94		3,305.26	
Fiscal year 1912.....	883,918	276,568.07	.3129	11,576.12	.0131	288,144.19	.3260
Fiscal year 1913.....	384,526	166,461.53	.4329	14,606.71	.0380	181,068.24	.4709
Total to June 30, 1914.....	1,756,977	526,007.57	.2994	35,916.28	.0204	561,923.85	.3198
Preparing foundations:							
Excavation—							
Fiscal year 1910...	33,843	85,109.77	2.5148	13,392.73	.3957	98,502.50	2.9105
Fiscal year 1911...	152,582	237,098.48	1.5540	27,640.92	.1811	264,739.40	1.7351
Fiscal year 1912...	8,888	26,307.20	2.9598	2,207.51	.2484	28,514.71	3.2082
Fiscal year 1913...	33,063	56,246.52	1.7012	5,995.89	.1813	62,242.41	1.8825
Total to June 30, 1914.....	228,376	404,761.97	1.7724	49,237.05	.2156	453,999.02	1.9880
Dredging, fiscal year 1913.....	19,814	36,581.03	1.8462	3,139.47	.1585	39,720.50	2.0047
Filling for approach walls—							
Fiscal year 1910...	17,883	10,607.43	.5932			10,607.43	.5932
Fiscal year 1911...	22,234	4,239.79	.1907	379.51	.0171	4,619.30	.2078
Fiscal year 1913...	1,544	1,161.41	.7522	126.33	.0818	1,287.74	.8340
Total to June 30, 1914.....	41,661	16,008.63	.3843	505.84	.0121	16,514.47	.3964

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE No. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—continued.							
Preparing foundations—Continued.							
Concrete piling—Approach walls, linear feet—	<i>Cu. yds.</i>						
Fiscal year 1911....	8,196	\$18,129.46	\$2.2120	\$635.29	\$0.0775	\$18,764.75	\$2.2895
Fiscal year 1912....	75,474	113,389.34	1.5032	2,418.27	.0320	115,807.61	1.5352
Fiscal year 1913....		3,833.00				3,833.00	
Fiscal year 1914....		3,337.76				3,337.76	
Total to June 30, 1914.....	83,670	138,689.56	1.6576	3,053.56	.0365	141,743.12	1.6941
Wooden piling—Approach walls, linear feet—							
Fiscal year 1912....	51,450	33,525.15	.6516	4,345.26	.0845	37,870.41	.7361
Fiscal year 1913....	200,549	110,389.05	.5504	16,353.33	.0816	126,742.38	.6320
Fiscal year 1914....		376.80				376.80	
Total to June 30, 1914.....	251,999	143,537.40	.5696	20,698.59	.0821	164,235.99	.6517
Masonry:							
Concrete, plain—							
May 4, 1904, to June 30, 1909.....		15,093.59		2,054.67		17,148.26	
Fiscal year 1910....	513,803	3,779,163.81	7.3553	204,596.95	.3983	3,983,760.76	7.7535
Fiscal year 1911....	902,926	5,952,003.08	6.5919	199,380.61	.2208	6,151,383.69	6.8127
Fiscal year 1912....	390,611	2,785,709.13	7.1317	103,230.79	.2643	2,888,939.92	7.3960
Fiscal year 1913....	137,749	900,643.05	6.5383	55,186.28	.4006	955,829.33	6.9389
Fiscal year 1914....	398	37,966.97	95.3944	8,886.42	22.3277	46,853.39	117.7221
Total to June 30, 1914.....	1,945,487	13,470,579.63	6.9252	573,335.72	.2948	14,043,915.35	7.2200
Concrete, reinforced:							
Fiscal year 1911....	8,211	102,216.13	12.4487	9,261.28	1.1279	111,477.41	13.5766
Fiscal year 1912....	59,883	707,983.96	11.8228	50,105.37	.8367	758,089.33	12.6595
Fiscal year 1913....	27,532	291,183.85	10.5762	32,140.82	1.1674	323,324.67	11.7436
Fiscal year 1914....	127	12,040.82	94.6605	2,991.70	23.5197	15,032.52	118.1802
Total to June 30, 1914.....	95,753	1,113,424.76	11.6282	94,499.17	.9869	1,207,923.93	12.6151
Total masonry....	2,041,240	14,584,004.39	7.1447	667,834.89	.3272	15,251,839.28	7.4719
Ironwork:							
Fiscal year 1910.....		226,554.37		26,112.31		252,666.68	
Fiscal year 1911.....		593,807.35		87,802.13		681,609.48	
Fiscal year 1912.....		337,786.43		42,566.42		380,352.85	
Fiscal year 1913.....		76,202.24		38,640.85		37,561.39	
Fiscal year 1914.....		6,564.72		2,956.79		9,521.51	
Total to June 30, 1914.....		1,240,915.11		120,796.80		1,361,711.91	
Gates and fender chains:							
Fiscal year 1911.....		40,586.48		5,999.82		46,586.30	
Fiscal year 1912.....		868,144.22		107,052.85		975,197.07	
Fiscal year 1913.....		1,320,190.55		47,180.95		1,273,009.60	
Fiscal year 1914.....		569,787.32		9,753.40		579,540.72	
Total to June 30, 1914.....		2,798,708.57		75,625.12		2,874,333.69	
Emergency dams:							
Fiscal year 1913.....		816,184.77		6,493.97		822,678.74	
Fiscal year 1914.....		54,346.15		1,305.07		53,041.08	
Total to June 30, 1914.....		761,838.62		7,799.04		769,637.66	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE No. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitratories for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—continued.							
Operating machinery:	<i>Cu. yds.</i>						
Fiscal year 1912.....		\$531,793.93		\$22,043.38		\$553,837.31	
Fiscal year 1913.....		1,836,370.15		72,778.48		1,909,148.63	
Fiscal year 1914.....		747,685.77		69,504.60		817,190.37	
Total to June 30, 1914.....		3,115,849.85		164,326.46		3,280,176.31	
Concrete in machinery installation:							
Fiscal year 1913.....	16,706	224,068.56	\$13.4124	21,632.01	\$1.2949	245,700.57	\$14.7073
Fiscal year 1914.....	9,785	104,714.13	10.7015	9,461.62	.9670	114,175.75	11.6685
Total to June 30, 1914.....	26,491	328,782.69	12.4111	31,093.63	1.1737	359,876.32	13.5848
Control house:							
Masonry—							
Fiscal year 1913...	568	15,459.54	27.2175	1,254.40	2.2085	16,713.94	29.4260
Fiscal year 1914...	94	7,607.77	81.2796	973.86	10.4045	8,581.63	91.6841
Total to June 30, 1914.....	662	23,067.31	34.8448	2,228.26	3.3660	25,295.57	38.2108
Ironwork and miscellaneous:—							
Fiscal year 1913...		3,511.28		62.29		3,573.57	
Fiscal year 1914...		27,813.01		3,394.96		31,207.97	
Total to June 30, 1914.....		31,324.29		3,457.25		34,781.54	
Machinery installation—							
Fiscal year 1913...		20.84				20.84	
Fiscal year 1914...		39,392.25		2,824.65		42,216.90	
Total to June 30, 1914.....		39,413.09		2,824.65		42,237.74	
Total, control house.....		93,804.69		8,510.16		102,314.85	
Buffer timbers:							
Fiscal year 1913.....		8,946.40		614.25		9,560.65	
Fiscal year 1914.....		7,436.51		260.04		7,696.55	
Total to June 30, 1914.....		16,382.91		874.29		17,257.20	
Crib fenders:							
Fiscal year 1913.....		10,479.86		817.22		11,297.08	
Fiscal year 1914.....		29,894.51		3,639.58		33,534.09	
Total to June 30, 1914.....		40,374.37		4,456.80		44,831.17	
Backfill:							
Fiscal year 1910.....	4,190	4,811.52	1.1483	388.29	.0927	5,199.81	1.2410
Fiscal year 1911.....	535,669	284,221.51	.5307	27,446.89	.0549	313,668.40	.5856
Fiscal year 1912.....	922,215	425,613.92	.4615	36,766.53	.0399	462,380.45	.5014
Fiscal year 1913.....	565,756	215,314.33	.3805	25,498.27	.0451	240,812.60	.4256
Fiscal year 1914.....	91,576	130,988.27	1.4304	20,778.06	.2269	151,766.33	1.6573
Total to June 30, 1914.....	2,119,406	1,060,949.55	.5007	112,878.04	.0532	1,173,827.59	.5539
Filling center wall:							
Fiscal year 1911.....	2,717	2,889.16	1.0634	212.09	.0780	3,101.25	1.1414
Fiscal year 1912.....	94,574	71,946.90	.7607	2,809.91	.0297	74,756.81	.7904
Fiscal year 1913.....	15,872	13,205.65	.8320	689.38	.0434	13,895.03	.8754
Fiscal year 1914.....		993.43				993.43	
Total to June 30, 1914.....	113,163	87,048.28	.7692	3,711.38	.0328	90,759.66	.8020

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE NO. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—continued.							
Filling around south approach wall, fiscal year 1912 (total):	<i>Cu. yds.</i>						
Dry.....	7,072	\$3,600.90	\$0.5092	\$176.71	\$0.0250	\$3,777.61	\$0.5342
Hydraulic.....	594,495	91,847.98	.1545	2,229.51	.0037	94,077.49	.1582
Total to June 30, 1914.....		95,448.88		2,406.22		97,855.10	
Cleaning up: Fiscal year 1914 (total).....		31,606.06		4,146.41		35,752.47	
Total Gatun Locks Plant—amount to be absorbed after June 30, 1914.....		28,338,109.10		1,657,476.30		29,995,585.40	
		109,036.36				109,036.36	
Total.....		28,447,145.46		1,657,476.30		30,104,621.76	
Gatun Dock: Fiscal year 1914 (total).....		7,537.34				7,537.34	
Total.....		28,454,682.80		1,657,476.30		30,112,159.10	
GATUN PERMANENT POWER PLANT.							
Excavation:							
Fiscal year 1912.....	72,119	27,163.41	.3767	1,596.61	.0221	28,760.02	.3988
Fiscal year 1913.....	26,632	27,011.32	1.0142	2,666.30	.1001	29,677.62	1.1143
Fiscal year 1914.....	25	687.34	27.4936	45.52	1.8208	732.86	29.3144
Total to June 30, 1914.....	98,776	54,862.07	.5554	4,308.43	.0436	59,170.50	.5990
Building:							
Fiscal year 1913.....		86,388.91		9,871.48		96,260.39	
Fiscal year 1914.....		187,206.10		14,526.03		201,732.13	
Total to June 30, 1914.....		273,595.01		24,397.51		297,992.52	
Operating machinery:							
Fiscal year 1912.....		8,855.00				8,855.00	
Fiscal year 1913.....		192,666.91		7,882.91		200,549.82	
Fiscal year 1914.....		98,733.69		8,260.15		106,993.84	
Total to June 30, 1914.....		300,255.60		16,143.06		316,398.66	
Total Gatun power plant.....		628,712.68		44,849.00		673,561.68	
Plant—amount to be absorbed after June 30, 1914.....		4,208.01				4,208.01	
Total.....		632,920.69		44,849.00		677,769.69	
GATUN-MINDI LEVEE.							
Dry filling:							
Fiscal year 1910.....	126,002	51,789.04	.4110	6,125.69	.0486	57,914.73	.4596
Fiscal year 1911.....	51,156	10,128.74	.1979	941.68	.0184	11,070.42	.2163
Fiscal year 1914.....	113,031	38,579.94	.3413	7,946.50	.0703	46,526.44	.4116
Total to June 30, 1914.....	290,189	100,497.72	.3463	15,013.87	.0517	115,511.59	.3980
Hydraulic filling:							
Fiscal year 1913 (total)	20,398	3,326.91	.1631	156.41	.0077	3,483.32	.1708
Total Gatun-Mindi levee.....		103,824.63		15,170.28		118,994.91	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE NO. 1.—Construction of canal from and including Gatun to the sea—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN-MINDI LEVEE—continued.							
Cano Saddle Dam—fiscal year 1914 (total).....	<i>Cu. yds.</i>	\$35,976.23		\$1,472.08		\$37,448.31	
Colon Breakwater (west):							
May 4, 1904, to June 30, 1909.....		7,501.98				7,501.98	
Fiscal year 1910.....		43,773.31		4,910.83		48,684.14	
Fiscal year 1911.....		522,084.39	\$1.4506	87,177.40	\$.2423	609,261.79	\$1.6929
Fiscal year 1912.....	359,890	916,821.49	1.7457	81,764.20	.1557	998,585.69	1.9014
Fiscal year 1913.....	525,173	896,512.68	4.8787	75,697.83	.4119	972,210.51	5.2906
Fiscal year 1914.....	183,762	1,106,087.42	5.3267	122,767.44	.5912	1,228,854.86	5.9179
Total to June 30, 1914.....	207,654						
Colon Breakwater (east), fiscal year 1914 (total).....	1,276,479	3,492,781.27	2.7362	372,317.70	.2917	3,865,098.97	3.0279
Plant—amount to be absorbed after June 30, 1914.....		202,293.40		14,495.95		216,789.35	
Total Colon Breakwater.....		163,124.20				163,124.20	
Total Colon Breakwater.....		3,858,198.87		386,813.65		4,245,012.52	
TERMINAL FACILITIES—CRISTOBAL.							
Coaling plant:							
Fiscal year 1913.....		1,424.55				1,424.55	
Fiscal year 1914.....		389,364.76		35,449.75		424,814.51	
Total coaling plant.....		390,789.31		35,449.75		426,239.06	
Fuel-oil tanks:							
Fiscal year 1913.....		13,063.59				13,063.59	
Fiscal year 1914.....		36,630.56				36,630.56	
Total fuel-oil tanks.....		49,694.15				49,694.15	
Total terminal facilities, Cristobal.....		440,483.46		35,449.75		475,933.21	
Plant—amount to be absorbed after June 30, 1914.....		35,270.51				35,270.51	
Total.....		475,753.97		35,449.75		511,203.72	
MANUFACTURING PLANTS.							
Amounts to be absorbed and adjusted after June 30, 1914:							
Porto Bello quarry.....		17,093.84				17,093.84	
Sea transportation.....		41,591.68				41,591.68	
Total.....		24,497.84				24,497.84	
Total Gatun to the sea.....		53,809,881.33		4,189,360.62		57,999,241.95	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 2.—Construction of canal from Gatun to Pedro Miguel.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation, prism:							
May 4, 1904, to June 30, 1909.....	<i>Cu. yds.</i> 40,983,366	\$37,567,549.31	\$0.9167	\$4,789,111.66	\$0.1169	\$42,356,660.97	\$1.0336
Fiscal year 1910.....	17,632,177	11,945,261.93	.6699	1,152,810.58	.0646	13,098,072.51	.7345
Fiscal year 1911.....	18,522,692	10,891,360.70	.5880	847,225.78	.0457	11,738,586.48	.6337
Fiscal year 1912.....	17,063,446	8,705,143.72	.5101	615,611.56	.0361	9,320,755.28	.5462
Fiscal year 1913.....	12,737,500	7,037,306.05	.5525	451,826.25	.0355	7,489,132.30	.5880
Fiscal year 1914.....	3,122,702	1,767,252.83	.5661	241,400.22	.0773	2,008,653.05	.6434
Total to June 30, 1914.....	110,261,883	77,913,874.54	.7066	8,097,986.05	.0734	86,011,860.59	.7800
Plant: Overcharge to construction to be adjusted on completion of work.....		116,837.53				116,837.53	
Total.....		77,797,037.01		8,097,986.05		85,895,023.06	
Dredging excavation, prism:							
Gatun Lake—							
May 4, 1904, to June 30, 1909.....		8,067.72		1,730.68		9,798.40	
Fiscal year 1914..	561,169	144,075.83	.2567	12,602.85	.0225	156,678.68	.2792
Total to June 30, 1914.....	561,169	152,143.55	.2711	14,333.53	.0256	166,477.08	.2967
Culebra Cut—							
Fiscal year 1913.....		183.47				183.47	
Fiscal year 1914..	3,432,363	1,782,912.55	.5195	158,282.31	.0461	1,941,194.86	.5656
Total to June 30, 1914.....	3,432,363	1,783,096.02	.5196	158,282.31	.0461	1,941,378.33	.5657
Total dredging.	3,993,532	1,935,239.57	.4848	172,615.84	.0432	2,107,855.41	.5280
Plant: Amount to be absorbed after June 30, 1914.....		711,026.33				711,026.33	
Total.....		2,646,265.90		172,615.84		2,818,881.74	
Hydraulic excavation, prism:							
Fiscal year 1913.....	57,274	10,511.46	.1835			10,511.46	.1835
Fiscal year 1914.....	1,384,455	276,453.44	.1997	27,193.54	.0196	303,646.98	.2193
Total to June 30, 1914.....	1,441,729	286,964.90	.1990	27,193.54	.0189	314,158.44	.2179
Clearing canal lines (acres):							
Fiscal year 1910.....	2,098	134,857.24	64.2789			134,857.24	64.2789
Fiscal year 1911.....	182	3,991.79	21.9329	467.38	2.5680	4,459.17	24.5009
Fiscal year 1912.....		2,029.51		80.83		2,110.34	
Fiscal year 1913.....	250	7,378.30	29.5132	546.17	2.1847	7,924.47	31.6979
Fiscal year 1914.....		6,969.54		830.42		7,799.96	
Total to June 30, 1914.....	2,530	155,226.38	61.3543	1,924.80	.7608	157,151.18	62.1151
Masonry:							
Fiscal year 1911.....	1,020	5,639.35	5.5288	585.09	.5736	6,224.44	6.1024
Fiscal year 1912.....	251	2,000.96	7.9719	128.26	.5110	2,129.22	8.4829
Total to June 30, 1914.....	1,271	7,640.31	6.0113	713.35	.5612	8,353.66	6.5725
Masonry facing (square yards) fiscal year 1912 (total).....	4,250	3,826.97	.9005	252.14	.0593	4,079.11	.9598
Total, Gatun to Pedro Miguel.....		80,896,961.47		8,300,685.72		89,197,647.19	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea.

	Quantities.	Total division ex- penses, including for arbitrariness plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation, prism:							
May 4, 1904, to June 30, 1909.....	<i>Cu. yds.</i> 139,470	\$119,747.16	\$0.8586	\$21,958.33		\$141,705.49	
Fiscal year 1910.....	99,703	63,266.48	.6345	6,622.63	\$0.0664	69,889.11	\$0.7009
Fiscal year 1911.....	198,770	138,349.00	.6960	12,662.38	.0637	151,011.38	.7597
Fiscal year 1912.....	864,475	650,658.11	.7527	37,383.22	.0432	688,041.33	.7959
Fiscal year 1913.....	3,210,851	2,126,300.10	.6622	148,889.65	.0464	2,275,189.75	.7086
Fiscal year 1914.....	306,700	157,446.64	.5134	28,667.16	.0935	186,113.80	.6069
Total to June 30, 1914.....	4,819,969	3,255,767.49	.6755	256,183.37	.0532	3,511,950.86	.7287
Plant, overcharge to con- struction to be ad- justed on completion of work.....		94,618.90				94,618.90	
Total.....		3,161,148.59		256,183.37		3,417,331.96	
Hydraulic excavation, prism:							
Fiscal year 1911.....	197,677	120,714.14	.6106	9,088.12	.0460	129,802.26	.6566
Fiscal year 1912.....	900,596	501,065.72	.5564	25,560.51	.0284	526,626.23	.5848
Fiscal year 1913.....	451,631	456,749.25	1.0113	7,729.61	.0171	464,478.86	1.0284
Total to June 30, 1914.....	1,549,904	1,078,529.11	.6959	42,378.24	.0274	1,120,907.35	.7233
Dredging excavation, prism:							
Pacific entrance—							
May 4, 1904, to June 30, 1909....	16,180,107	3,431,026.11	.2121	290,071.88	.0179	3,721,097.99	.2300
Fiscal year 1910.....	6,857,223	1,650,894.38	.2408	156,092.09	.0229	1,806,986.47	.2635
Fiscal year 1911.....	5,549,642	1,398,087.35	.2519	136,071.78	.0245	1,534,159.13	.2764
Fiscal year 1912.....	3,884,287	738,025.36	.1900	68,519.58	.0176	806,544.94	.2076
Fiscal year 1913.....	4,321,956	1,399,473.58	.3238	131,561.14	.0304	1,531,034.72	.3542
Fiscal year 1914.....	3,169,255	807,316.11	.2547	99,257.13	.0313	906,573.24	.2860
Total to June 30, 1914.....	39,962,470	9,424,822.89	.2358	881,573.60	.0221	10,306,396.49	.2579
Miraflores Lake, fiscal year 1914 (total).....	159,817	50,809.31	.3179	2,968.71	.0186	53,778.02	.3365
Total dredging.....	40,122,287	9,475,632.20	.2362	884,542.31	.0220	10,360,174.51	.2582
Plant, amount to be ab- sorbed after June 30, 1914.....		637,027.88				637,027.88	
Total.....		10,112,660.08		884,542.31		10,997,202.39	
PEDRO MIGUEL DAMS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	4,074	5,241.81	1.2866			5,241.81	1.2866
Fiscal year 1910.....		925.47				925.47	
Fiscal year 1912.....	3,937	5,915.97	1.5026	445.35	.1132	6,361.32	1.6158
Fiscal year 1913.....	2,464	6,956.46	2.8233	640.11	.2598	7,596.57	3.0831
Total to June 30, 1914.....	10,475	19,039.71	1.8177	1,085.46	.1036	20,125.17	1.7213
Dry filling:							
May 4, 1904, to June 30, 1909.....	167,061	71,275.77	.4266	9,985.14	.0598	81,260.91	.4864
Fiscal year 1910.....	93,791	36,205.63	.3860	3,892.31	.0415	40,097.94	.4275
Fiscal year 1911.....		4,058.42		584.55		4,642.97	
Fiscal year 1912.....	321,589	162,084.64	.5040	4,107.42	.0128	166,192.06	.5168
Fiscal year 1913.....	114,117	37,793.84	.3312	3,087.98	.0270	40,881.82	.3582
Fiscal year 1914.....	2,960	3,327.54	1.1242	374.96	.1266	3,702.50	1.2508
Total to June 30, 1914.....	699,518	314,745.84	.4500	22,032.36	.0315	336,778.20	.4815

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitrariness for plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PEDRO MIGUEL DAMS— continued.							
Masonry:	<i>Cu. yds.</i>						
Fiscal year 1913.....	1,567	\$7,872.65	\$5.0240	\$569.17	\$0.3632	\$8,441.82	\$5.3872
Fiscal year 1914.....		30.48				30.48	
Total to June 30, 1914.....	1,567	7,842.17	5.0046	569.17	.3632	8,411.34	5.3678
Total Pedro Miguel dams.....		341,627.72		23,686.99		365,314.71	
PEDRO MIGUEL LOCKS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	720,157	510,548.44	.7089	78,170.80	.1085	588,719.24	.8174
Fiscal year 1910.....	298,500	354,524.81	1.1876	48,521.97	.1626	403,046.68	1.3502
Fiscal year 1911.....	16,423	9,838.84	.5991	966.86	1.0589	10,805.70	.6580
Fiscal year 1912.....	95,156	28,714.09	.3018	2,690.30	.0283	31,413.39	.3301
Fiscal year 1913.....	3,044	1,241.40	.4078	61.96	.0204	1,303.36	.4282
Total to June 30, 1914.....	1,133,280	904,867.58	.7985	130,420.79	.1151	1,035,288.37	.9136
Preparing foundations:							
Fiscal year 1910.....	44,948	126,722.55	2.8193	14,916.60	.3319	141,639.15	3.1512
Fiscal year 1911.....	76,847	182,477.38	2.3746	22,073.06	.2872	204,550.44	2.6618
Fiscal year 1912.....	38,826	84,311.91	2.1715	8,314.88	.2142	92,626.79	2.3857
Fiscal year 1913.....	15,366	36,702.18	2.3885	3,888.78	.2531	40,590.96	2.6416
Fiscal year 1914.....		8.43		17.50		9.07	
Total to June 30, 1914.....	175,987	430,205.59	2.4446	49,210.82	.2796	479,416.41	2.7242
Masonry:							
Concrete, plain—							
Fiscal year 1910...	166,869	1,016,107.42	6.0892	86,704.98	.5196	1,102,812.40	6.6088
Fiscal year 1911...	497,802	2,341,652.75	4.7042	138,716.42	.2787	2,480,369.17	4.9827
Fiscal year 1912...	134,193	767,363.31	5.7183	41,391.93	.3085	808,755.24	6.0268
Fiscal year 1913...	39,465	258,228.58	6.5432	19,109.65	.4842	277,338.23	7.0274
Fiscal year 1914...	1,069	21,979.40	20.5579	3,411.17	3.1905	25,390.57	23.7484
Total to June 30, 1914.....	839,398	4,405,331.46	5.2485	289,334.15	.3447	4,694,665.61	5.5932
Concrete, reinforced—							
Fiscal year 1911...	385	6,830.91	17.7426	773.16	2.0082	7,604.07	19.7508
Fiscal year 1912...	48,677	414,705.14	8.5195	31,361.01	.6443	446,066.15	9.1638
Fiscal year 1913...	18,697	177,022.08	9.4679	20,424.19	1.0924	197,446.27	10.5603
Fiscal year 1914...	18	2,317.23	128.7350	1,003.58	55.7544	3,320.81	184.4894
Total to June 30, 1914.....	67,777	600,875.36	8.8655	53,561.94	.7903	654,437.30	9.6558
Total masonry..	907,175	5,006,206.82	5.5188	342,896.09	.3780	5,349,102.91	5.8968
Ironwork:							
May 4, 1904, to June 30, 1909.....		108,843.27		8,190.96		117,034.23	
Fiscal year 1910.....		143,491.51		3,834.93		147,326.44	
Fiscal year 1911.....		227,470.23		20,665.80		248,136.03	
Fiscal year 1912.....		100,906.24		19,821.24		120,727.48	
Fiscal year 1913.....		45,120.38		7,123.29		37,997.09	
Fiscal year 1914.....		3,539.82		889.12		2,650.70	
Total to June 30, 1914.....		622,291.81		46,278.76		668,570.57	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PEDRO MIGUEL LOCKS— continued.							
Gates:	<i>Cu. yds.</i>						
Fiscal year 1911.....		\$6,025.59		\$878.77		\$6,904.36	
Fiscal year 1912.....		776,718.78		20,434.97		797,153.75	
Fiscal year 1913.....		590,814.13		12,632.57		578,181.56	
Fiscal year 1914.....		415,836.83		5,458.56		421,295.39	
Total to June 30, 1914.....		1,78,395.33		14,139.73		1,803,535.06	
Emergency dams:							
Fiscal year 1913.....		512,480.47		382.02		512,862.49	
Fiscal year 1914.....		295,362.59		1,997.61		297,360.20	
Total to June 30, 1914.....		807,843.06		2,379.63		810,222.69	
Operating machinery:							
Fiscal year 1912.....		168,096.64		6,232.82		174,329.46	
Fiscal year 1913.....		1,070,009.31		39,285.60		1,109,294.91	
Fiscal year 1914.....		645,975.52		58,462.42		704,437.94	
Total to June 30, 1914.....		1,884,081.47		103,980.84		1,988,062.31	
Concrete in machine in- stallation:							
Fiscal year 1913.....	10,190	123,767.97	\$12.1460	11,389.03	\$1.1177	135,157.00	\$13.2637
Fiscal year 1914.....	10,961	122,031.13	11.1332	14,421.56	1.3157	136,452.69	12.4489
Total to June 30, 1914.....	21,151	245,799.10	11.6212	25,810.59	1.2203	271,609.69	12.8415
Control House:							
Masonry—							
Fiscal year 1913...	205	8,197.62	39.9884	371.34	1.8114	8,568.96	41.7998
Fiscal year 1914...	592	36,998.78	62.5423	6,354.14	10.7410	43,352.92	73.2833
Total to June 30, 1914.....	797	45,196.40	56.7082	6,725.48	8.4385	51,921.88	65.1467
Ironwork and miscel- laneous—							
Fiscal year 1913...		5,661.90				5,661.90	
Fiscal year 1914...		17,663.65		3,050.50		20,714.15	
Total to June 30, 1914.....		23,325.55		3,050.50		26,376.05	
Machinery installa- tion—							
Fiscal year 1913...		3.46				3.46	
Fiscal year 1914...		27,911.75		2,316.69		30,228.44	
Total to June 30, 1914.....		27,915.21		2,316.69		30,231.90	
Total control house.....		96,437.16		12,092.67		108,529.83	
Buffer timbers:							
Fiscal year 1913.....		9,365.08		448.53		9,813.61	
Fiscal year 1914.....		6,250.99		1,946.75		8,197.74	
Total to June 30, 1914.....		15,616.07		2,395.28		18,011.35	
Crib fenders:							
Fiscal year 1914 (total)		18,579.66		3,139.81		21,719.47	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries plant.		Administra tive and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PEDRO MIGUEL LOCKS— continued.							
Back fill:	<i>Cu. yds.</i>						
Fiscal year 1910.....	9,616	\$2,737.77	\$0.2847	\$278.81	\$0.0290	\$3,016.58	\$0.3137
Fiscal year 1911.....	273,709	106,753.75	.3900	8,619.21	.0315	115,372.96	.4215
Fiscal year 1912.....	349,275	123,456.12	.3535	7,944.35	.0227	131,400.47	.3762
Fiscal year 1913.....	173,938	80,738.23	.4642	7,187.30	.0413	87,925.53	.5055
Fiscal year 1914.....	27,750	30,930.25	1.1146	4,216.63	.1520	35,146.88	1.2666
Total to June 30, 1914.....	834,288	344,616.12	.4131	28,246.30	.0339	372,862.42	.4470
Filling center wall:							
Fiscal year 1912.....	21,937	21,131.29	.9633	1,677.84	.0765	22,809.13	1.0398
Fiscal year 1913.....	193,212	75,259.22	.3895	5,717.30	.0296	80,976.52	.4191
Fiscal year 1914.....	5,619	9,068.64	1.6139	2,807.53	.4997	11,876.22	2.1136
Total to June 30, 1914.....	220,768	105,459.15	.4777	10,202.72	.0462	115,661.87	.5239
Cleaning up:							
Fiscal year 1914 (total)		21,449.49	.....	3,313.51	.....	24,763.00	.....
Total Pedro Miguel Locks.....		12,292,848.41	.....	774,507.54	.....	13,067,355.95	.....
Total Pedro Miguel Locks and Dams		12,634,476.13	.....	798,194.53	.....	13,432,670.66	.....
Plant—amount to be ab- sorbed after June 30, 1914.....		24,123.65	.....	.....	.....	24,123.65	.....
Total.....		12,658,599.78	.....	798,194.53	.....	13,456,794.31	.....
MIRAFLORES EAST DAM AND SPILLWAY.							
Dry excavation:							
Fiscal year 1912.....		9,874.07	.....	962.67	.....	10,836.74	.....
Fiscal year 1913.....	134,671	216,835.99	1.6101	15,982.70	.1187	232,818.69	1.7288
Fiscal year 1914.....	107,728	76,327.50	.7085	7,682.46	.0713	84,009.96	.7798
Total to June 30, 1914.....	242,399	303,037.56	1.2502	24,627.83	.1016	327,665.39	1.3518
Dry excavation, channel south:							
Fiscal year 1914 (total)	26,338	18,368.28	.6974	1,194.97	.0454	19,563.25	.7428
Masonry:							
Concrete, plain—							
Fiscal year 1913...	63,707	366,672.90	5.7556	25,084.02	.3937	391,756.92	6.1493
Fiscal year 1914...	9,570	79,918.94	8.3510	23,440.14	2.4493	103,359.08	10.8003
Total to June 30, 1914.....	73,277	446,591.84	6.0946	48,524.16	.6622	495,116.00	6.7568
Concrete, reinforced—							
Fiscal year 1913...	435	8,536.26	19.6000	619.07	1.4214	9,155.33	21.0214
Fiscal year 1914...	542	6,435.14	11.8730	1,163.60	2.1468	7,598.74	14.0198
Total to June 30, 1914.....	977	14,971.40	15.3238	1,782.67	1.8246	16,754.07	17.1484
Total masonry..	74,254	461,563.24	6.2160	50,306.83	.6775	511,870.07	6.8935
Ironwork:							
Fiscal year 1912.....		19,282.32	.....	1,404.89	.....	20,687.21	.....
Fiscal year 1913.....		2,248.09	.....	1,387.49	.....	3,635.58	.....
Fiscal year 1914.....		7,564.04	.....	985.79	.....	8,549.83	.....
Total to June 30, 1914.....		29,094.45	.....	3,778.17	.....	32,872.62	.....

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitrarle; for plant.		Adminlstrative and general ex- penses.		Total cost	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit. cost.
MIRAFLORES EAST DAM AND SPILLWAY—CON.							
Gates and caissons:	Cu. yds.						
Fiscal year 1913.....		\$40,625.69				\$40,625.69	
Fiscal year 1914.....		7,594.08		\$1,321.46		8,915.54	
Total to June 30, 1914.....		48,219.77		1,321.46		49,541.23	
Operating machinery:							
Fiscal year 1913.....		64,299.22		1,346.32		65,645.54	
Fiscal year 1914.....		40,212.88		3,086.31		43,299.19	
Total to June 30, 1914.....		104,512.10		4,432.63		108,944.73	
Concrete in machinery in- stallation, fiscal year 1914 (total).....	59	3,110.85	\$52.7263	394.93	\$6.6937	3,505.78	\$59.4200
Dike and trestle bridge, fiscal year 1914 (total)...		43,055.93		4,238.85		47,294.78	
Cleaning up, fiscal year 1914 (total).....		1,888.93		221.73		2,110.66	
Total Miraflores east dam and spillway.....		1,012,851.11		90,517.40		1,103,368.51	
MIRAFLORES WEST DAM.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	13,986	19,681.84	1.4073			19,681.84	1.4073
Fiscal year 1910.....	550	299.74	.5450	9.68	.0176	309.42	.5626
Fiscal year 1913.....	9,923	5,332.51	.5374	358.00	.0361	5,690.51	.5735
Fiscal year 1914.....		234.98		48.93		283.91	
Total to June 30, 1914.....	24,459	25,549.07	1.0446	416.61	.0170	25,965.68	1.0616
Masonry:							
Fiscal year 1910.....		388.59		40.92		429.51	
Fiscal year 1912.....		84.97		7.83		92.80	
Fiscal year 1913.....	4,403	19,078.38	4.3300	1,808.26	.4107	20,886.64	4.7437
Fiscal year 1914.....	122	663.01	5.4345	71.53	.5863	734.54	6.0208
Total to June 30, 1914.....	4,525	20,214.95	4.4674	1,928.54	.4262	22,143.49	4.8936
Dry filling:							
May 4, 1904, to June 30, 1909.....	363,418	172,058.40	.4694	22,311.58	.0654	194,369.98	.5348
Fiscal year 1910.....	157,483	106,686.04	.6774	12,828.58	.0815	119,514.62	.7589
Fiscal year 1911.....	295,598	121,256.20	.4102	8,806.63	.0298	130,062.83	.4400
Fiscal year 1912.....	425,125	171,936.88	.4044	8,267.23	.0195	180,204.11	.4239
Fiscal year 1913.....	418,375	170,546.97	.4076	11,688.63	.0280	182,235.60	.4356
Fiscal year 1914.....	98,424	63,293.29	.6431	7,050.03	.0716	70,343.32	.7147
Total to June 30, 1914.....	1,758,423	805,777.78	.4582	70,952.68	.0404	876,730.46	.4986
Hydraulic filling:							
Fiscal year 1910.....		3,665.16		412.70		4,077.86	
Fiscal year 1911.....		16,674.85		1,987.59		18,662.44	
Fiscal year 1912.....		10,094.39		895.46		10,989.85	
Fiscal year 1913.....		18,376.34		854.45		19,230.79	
Fiscal year 1914.....		4,679.75		1,683.40		6,363.15	
Total to June 30, 1914.....		53,490.49		5,833.60		59,324.09	
Total Miraflores west dam.....		905,032.29		79,131.43		984,163.72	

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
MIRAFLORES LOCKS.							
Dry excavation:							
Diversions—							
Fiscal year 1910	<i>Cu. yds.</i>						
(total).....	5,885	\$2,028.98	\$0.3448			\$2,028.98	\$0.3448
In lock site—							
May 4, 1904, to							
June 30, 1909....	1,120,342	912,773.07		\$166,697.67		1,079,470.74	
Fiscal year 1910...	229,793	303,825.88	1.3222	42,925.57	\$0.1868	346,751.45	1.5090
Fiscal year 1911...	247,700	182,758.81	.7378	17,645.43	.0712	200,404.24	.8090
Fiscal year 1912...	624,747	410,197.14	.6566	31,729.05	.0508	441,926.19	.7074
Fiscal year 1913...				1,367.28		1,367.28	
Total to June							
30, 1914.....	2,222,582	1,809,554.90	.8143	257,630.44	.1159	2,067,185.34	.9302
Dredging excavation:							
May 4, 1904, to							
June 30, 1909....	167,888	57,408.31	.3418	6,587.95	.0393	63,996.26	.3811
Fiscal year 1910...	141,759	71,784.25	.5063	6,599.15	.0466	78,383.40	.5529
Total to June 30,							
1914.....	309,647	129,192.56	.4172	13,187.10	.0426	142,379.66	.4598
Hydraulic excavat ion,							
fiscal year 1911 (total)...	332,703	182,526.79	.5486	12,772.23	.0384	195,299.02	.5870
Preparing foundations:							
Excavation—							
Fiscal year 1910...	64,036	124,669.74	1.9469	15,952.08	.2491	140,621.82	2.1960
Fiscal year 1911...	137,752	221,569.09	1.6085	27,351.86	.1985	248,920.95	1.8070
Fiscal year 1912...	165,145	258,894.68	1.5677	23,853.75	.1444	282,748.43	1.7121
Fiscal year 1913...	49,048	109,653.13	2.2356	11,172.19	.2278	120,825.32	2.4634
Fiscal year 1914...		58.42				58.42	
Total to June							
30, 1914.....	415,981	714,728.22	1.7182	78,329.88	.1883	793,058.10	1.9065
Wooden piling (linear							
feet)—							
Fiscal year 1912...	6,580	50,264.36	7.6390	3,582.18	.5444	53,846.54	8.1834
Fiscal year 1913...	38,125	5,988.22	.1571	663.92	.0174	6,652.14	.1745
Fiscal year 1914...		1,623.92				1,623.92	
Total to June							
30, 1914.....	44,705	54,628.66	1.2220	4,246.10	.0950	58,874.76	1.3170
Masonry:							
Concrete, plain—							
Fiscal year 1910...	1,630	12,050.56	7.3929	1,173.62	.7200	13,224.18	8.1129
Fiscal year 1911...	272,933	1,278,048.03	4.6823	85,998.07	.3151	1,364,046.10	4.9977
Fiscal year 1912...	729,096	3,344,155.62	4.5867	163,285.44	.2240	3,507,441.06	4.8107
Fiscal year 1913...	402,607	2,024,007.36	5.0273	148,806.91	.3696	2,172,814.27	5.3969
Fiscal year 1914...	2,218	45,424.59	20.4800	7,874.07	3.5501	53,298.66	24.0301
Total to June							
30, 1914.....	1,408,484	6,703,686.16	4.7596	407,138.11	.2891	7,110,824.27	5.0487
Concrete, reinforced—							
Fiscal year 1912...	22,444	238,776.94	10.6388	18,341.91	.8172	257,118.85	11.4560
Fiscal year 1913...	48,185	520,508.01	10.8023	50,962.64	1.0576	571,470.65	11.8599
Fiscal year 1914...	626	13,339.31	21.3088	2,943.30	4.7018	16,282.61	26.0106
Total to June							
30, 1914.....	71,255	772,624.26	10.8431	72,247.85	1.0139	844,872.11	11.8570
Total masonry.....	1,479,739	7,476,310.42	5.0525	479,385.96	.3240	7,955,696.38	5.3765

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
MIRAFLORES LOCKS—CON.							
Ironwork:	<i>Cu. yds.</i>						
Fiscal year 1910.....		\$92,950.46		\$2,490.41		\$95,440.87	
Fiscal year 1911.....		413,153.74		34,433.35		447,587.09	
Fiscal year 1912.....		232,241.41		29,325.29		261,566.70	
Fiscal year 1913.....		123,017.79		634.49		123,652.28	
Fiscal year 1914.....		10,619.23		4,062.14		14,681.37	
Total to June 30, 1914.....		871,982.63		70,945.68		942,928.31	
Gates:							
Fiscal year 1912.....		129,400.09		22,899.20		152,299.29	
Fiscal year 1913.....		1,104,445.28		5,253.34		1,099,191.94	
Fiscal year 1914.....		663,670.84		8,646.59		672,317.43	
Total to June 30, 1914.....		1,897,516.21		26,292.45		1,923,808.66	
Emergency dams:							
Fiscal year 1913.....		38,803.75		553.69		39,357.44	
Fiscal year 1914.....		598,499.24		3,946.93		602,446.17	
Total to June 30, 1914.....		637,302.99		4,500.62		641,803.61	
Operating machinery:							
Fiscal year 1912.....		160,565.32		6,494.50		167,059.82	
Fiscal year 1913.....		1,290,340.70		38,737.52		1,329,078.22	
Fiscal year 1914.....		981,543.50		90,165.61		1,071,709.11	
Total to June 30, 1914.....		2,432,449.52		135,397.63		2,567,847.15	
Concrete in machinery installation:							
Fiscal year 1913.....	9,814	110,911.38	\$11.3013	8,747.01	\$0.8913	119,658.39	\$12.1926
Fiscal year 1914.....	18,241	207,371.77	11.3685	26,229.46	1.4379	233,601.23	12.8064
Total to June 30, 1914.....	28,055	318,283.15	11.3450	34,976.47	1.2467	353,259.62	12.5917
Control house:							
Masonry fiscal year 1914 (total).....	949	54,321.40	57.2407	8,056.69	8.4897	62,378.09	65.7304
Ironwork and miscel- laneous, fiscal year 1914 (total).....		22,190.76		3,698.92		25,889.68	
Machinery installa- tion, fiscal year 1914 (total).....		40,751.20		2,160.99		42,912.19	
Total control house.		117,263.36		13,916.60		131,179.96	
Buffer timbers:							
Fiscal year 1913.....		6,169.10		816.03		6,985.13	
Fiscal year 1914.....		338.83		67.04		405.87	
Total to June 30, 1914.....		6,507.93		883.07		7,391.00	
Crib fenders, fiscal year 1914 (total).....		53,081.06		6,543.57		59,624.63	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
MIRAFLORES LOCKS—con.							
Backfill:							
May 4, 1904, to June 30, 1909.....	<i>Cu. yds.</i> 409,211	\$36,801.83	\$0.0899	\$6,246.87	\$0.0158	\$43,048.70	\$0.1052
Fiscal year 1910.....	121,080	52,170.32	.4309	6,741.18	.0557	58,911.50	.4866
Fiscal year 1911.....	53,521	22,976.42	.4293	2,557.17	.0478	25,533.59	.4771
Fiscal year 1912.....	442,774	184,794.90	.4174	11,574.39	.0261	196,369.29	.4435
Fiscal year 1913.....	979,468	398,448.50	.4068	32,474.60	.0362	430,923.10	.4400
Fiscal year 1914.....	360,198	216,860.54	.6021	27,945.59	.0775	244,806.13	.6796
Total to June 30, 1914.....	2,366,252	912,052.51	.3855	87,539.80	.0370	999,592.31	.4225
Filling center wall:							
Fiscal year 1912.....	7,912	8,011.43	1.0126	403.09	.0509	8,414.52	1.0635
Fiscal year 1913.....	149,301	89,174.58	.5973	6,027.48	.0404	95,202.06	.6377
Fiscal year 1914.....	92,244	48,640.13	.5273	8,202.01	.0889	56,842.14	.....
Total to June 30, 1914.....	249,457	145,826.14	.5846	14,632.58	.0587	160,458.72	.6433
Cleaning up, fiscal year 1914 (total).....		42,953.51	.....	6,351.26	.....	49,304.77	.....
Permanent tracks:							
Fiscal year 1914 (total).....		5,204.52	.....	241.70	.....	5,446.22	.....
Total Miraflores locks.....		17,809,394.06	.....	1,247,773.14	.....	19,057,167.20	.....
Total Miraflores locks and dams.....		19,727,277.46	.....	1,417,421.97	.....	21,144,699.43	.....
LA BOCA LOCKS AND DAMS.							
Dry excavation, May 4, 1904, to June 30, 1909 (total).....	78,233	131,254.40	1.6777	27,088.89	.3463	158,343.29	2.0240
Construction:							
Dam, May 4, 1904, to June 30, 1909 (total).....		288,601.56	.....	26,748.51	.....	315,350.07	.....
Locks, May 4, 1904, to June 30, 1909 (total).....		145,828.37	.....	13,478.03	.....	159,306.40	.....
Total La Boca locks and dams.....	78,233	565,684.33	.....	67,315.43	.....	632,999.76	.....
Total lower locks and dams—Pacific entrance.....		20,292,961.79	.....	1,484,737.40	.....	21,777,699.19	.....
Plant—Overcharge to construction to be adjusted on completion of work.....		23,495.58	.....			23,495.58	.....
Total.....		20,269,466.21	.....	1,484,737.40	.....	21,754,203.61	.....
Naos Island Breakwater:							
Fiscal year 1910.....	782,021	36,847.73	.2467	20.03		36,867.76	.2467
Fiscal year 1911.....		21,238.30				21,238.30	
Fiscal year 1912.....		134,839.41				134,839.41	
Fiscal year 1913.....	653,137	191,615.45	.2934	20,539.96	.0314	212,155.41	.3248
Fiscal year 1914.....	652,587	397,616.22	.6088	48,355.07	.0741	445,971.29	.6829
Total to June 30, 1914.....	2,087,745	782,157.11	.3747	68,915.06	.0330	851,072.17	.4077

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
TERMINAL FACILITIES— BALBOA.							
Preliminary work:	<i>Cu. yds.</i>						
Fiscal year 1911.....		\$16,277.26		\$2,114.44		\$18,391.70	
Fiscal year 1912.....		1,175.16		257.48		917.68	
Fiscal year 1913.....		13,326.59		1,476.67		14,803.26	
Fiscal year 1914.....		6,719.57		652.99		7,372.56	
Total to June 30, 1914.....		35,148.26		4,501.58		39,649.84	
Preparing site:							
Miscellaneous—							
Fiscal year 1911.....		4,547.08		478.49		5,025.57	
Fiscal year 1912.....		27,200.94		1,004.22		28,205.16	
Fiscal year 1913.....		135,879.24		7,914.80		143,794.04	
Fiscal year 1914.....		267,819.71		17,969.96		285,789.67	
Total to June 30, 1914.....		435,446.97		27,367.47		462,814.44	
Excavation—							
Fiscal year 1912... 23,140		19,785.26	\$0.8550	1,687.36	\$0.0729	21,472.62	\$0.9279
Fiscal year 1913... 389,567		212,172.31	.5447	15,554.56	.0399	227,726.87	.5846
Fiscal year 1914... 5,855		13,499.44	2.3056	715.95	.1223	14,215.39	2.4279
Total to June 30, 1914.....	418,562	245,457.01	.5864	17,957.87	.0429	263,414.88	.6293
Filling—							
Fiscal year 1912... 23,140		10,739.54	.4641	826.56	.0357	11,566.10	.4998
Fiscal year 1913... 482,279		191,024.53	.3961	12,207.78	.0253	203,232.31	.4214
Fiscal year 1914... 258,623		110,843.41	.4286	11,140.01	.0431	121,983.42	.4717
Total to June 30, 1914.....	764,042	312,607.48	.4092	24,174.35	.0316	336,781.83	.4408
Curundu River drain- age culvert, fiscal year 1914 (total).....		41,137.01		9,336.10		50,473.11	
Yards and tracks:							
Fiscal year 1912.....		6,421.98		601.57		7,023.55	
Fiscal year 1913.....		8,629.63		790.64		9,420.27	
Fiscal year 1914.....		23,924.97		655.97		24,580.94	
Total to June 30, 1914.....		38,976.58		2,048.18		41,024.76	
Dredging inner basin:							
Fiscal year 1912..... 370,607		58,549.14	.1580	5,594.70	.0151	64,143.84	.1731
Fiscal year 1913..... 1,401,207		215,567.78	.1538	19,887.36	.0142	235,455.14	.1680
Fiscal year 1914..... 1,926,967		318,854.74	.1655	30,191.07	.0157	349,045.81	.1812
Total to June 30, 1914.....	3,698,781	592,971.66	.1603	55,673.13	.0151	648,644.79	.1754
Main dry dock:							
Fiscal year 1911.....		1,563.65		192.16		1,755.81	
Fiscal year 1912.....		10,157.81		921.13		11,078.94	
Fiscal year 1913.....		131,783.01		7,231.67		139,014.68	
Fiscal year 1914.....		360,816.12		29,335.74		390,151.86	
Total to June 30, 1914.....		504,320.59		37,680.70		542,001.29	
Dry Dock No. 2, fiscal year 1914 (total).....		78,312.02		9,508.09		87,820.11	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 3.—Construction of canal from and including Pedro Miguel to the sea—Continued.

	Quantities.	Total division ex- penses, including arbitraries plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
TERMINAL FACILITIES— BALBOA—continued.							
Coaling plant:	Cu. yds.						
Fiscal year 1912.....		\$1,237.89		\$124.16		\$1,362.05	
Fiscal year 1913.....		50,295.26		2,879.81		53,175.07	
Fiscal year 1914.....		235,736.02		12,861.66		248,597.68	
Total to June 30, 1914.....		287,269.17		15,865.63		303,134.80	
Entrance basin, fiscal year 1914 (total).....	388,118	386,004.07	\$0.9946	28,943.67	\$0.0746	414,947.74	\$1.0692
Sea wall:							
Fiscal year 1913.....		2.73		.26		2.99	
Fiscal year 1914.....		124.12		5.50		129.62	
Total to June 30, 1914.....		126.85		5.76		132.61	
Permanent shops:							
Fiscal year 1912.....		3,653.35				3,653.35	
Fiscal year 1913.....		271,598.70		24,275.32		295,874.02	
Fiscal year 1914.....		2,169,210.18		166,632.05		2,335,842.23	
Total to June 30, 1914.....		2,444,462.23		190,907.37		2,635,369.60	
Docks:							
Fiscal year 1912.....		3,653.35				3,653.35	
Fiscal year 1913.....		287,502.30		25,709.97		313,212.27	
Fiscal year 1914.....		921,761.36		99,095.08		1,020,856.44	
Total to June 30, 1914.....		1,212,917.01		124,805.05		1,337,722.06	
Fuel-oil tanks:							
Fiscal year 1913.....		2,676.18		24.41		2,700.59	
Fiscal year 1914.....		41,636.20		324.22		41,960.42	
Total to June 30, 1914.....		44,312.38		348.63		44,661.01	
Dredging berth for oil ships:							
Fiscal year 1914 (total)		5,976.95		92.14		6,069.09	
Total terminal facil- ities—Balboa.....		6,665,446.24		549,215.72		7,214,661.96	
Plant—amount to be ab- sorbed after June 30, 1914		134,175.77				134,175.77	
Total.....		6,799,622.01		549,215.72		7,348,837.73	
Manufacturing plant:							
Amount to be ab- sorbed after June 30, 1914—							
Electric power plant.....		208,609.96				208,609.96	
Ancon rock quarry		24,417.18				24,417.18	
Chame sand plant.		7,724.95				7,724.95	
Total.....		176,467.83				176,467.83	
Total Pedro Mi- guel to the sea.....		55,038,650.72		4,084,166.63		59,122,817.35	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 4.—Miscellaneous.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PERMANENT TOWNSITES.							
Balboa:							
Fiscal year 1913.....		\$45,807.55		\$3,535.70		\$49,343.25	
Fiscal year 1914.....		363,308.80		31,184.39		394,493.19	
Total to June 30, 1914.....		409,116.35		34,720.09		443,836.44	
La Boca, fiscal year 1914 (total).....		132,539.23		10,366.18		142,905.41	
Pedro Miguel, fiscal year 1914 (total).....		112,349.25		14,868.13		127,217.38	
Total permanent town sites.....		654,004.83		59,954.40		713,959.23	
PERMANENT BUILDINGS.							
Designing, general:							
Fiscal year 1913.....		20,445.51				20,445.51	
Fiscal year 1914.....		7,144.01		1,469.66		5,674.35	
Total to June 30, 1914.....		13,301.50		1,469.66		14,771.16	
Concrete buildings:							
Administration building—							
Fiscal year 1913.....		32,976.61		1,319.31		34,295.92	
Fiscal year 1914.....		683,959.48		71,653.60		755,613.08	
Total to June 30, 1914.....		716,936.09		72,972.91		789,909.00	
Four-family quarters, fiscal year 1914 (total).....		425,210.17		45,372.15		470,582.32	
Two-family quarters, fiscal year 1914 (total).....		20,737.76		955.75		21,693.51	
Miscellaneous buildings, fiscal year 1914 (total).....		4,691.48		210.35		4,901.83	
Wooden buildings erected:							
Laborers' quarters, La Boca—							
Fiscal year 1913.....		9,147.86				9,147.86	
Fiscal year 1914.....		148,082.43				148,082.43	
Total to June 30, 1914.....		157,230.29				157,230.29	
Employees' quarters, Balboa, fiscal year 1914 (total).....		81,962.85				81,962.85	
Employees' quarters, Paraiso, fiscal year 1914 (total).....		1,447.73				1,447.73	
Employees' quarters, Pedro Miguel, fiscal year 1914 (total).....		19,703.53				19,703.53	
Total permanent buildings.....		1,441,221.40		120,980.82		1,562,202.22	

NOTE.—Bold-face type indicates credit.

EXHIBIT A.—CONSTRUCTION EXPENDITURES TO JUNE 30, 1914—Continued.

TABLE 4.—Miscellaneous—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general ex- penses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PERMANENT BUILDINGS— Continued.							
Plant—Amount to be ab- sorbed after June 30, 1914.....		\$21,349.06				\$21,349.06	
Total.....		1,462,570.46		\$120,980.82		1,583,551.28	
LIGHTS AND BUOYS.							
Fiscal year 1911.....		12,055.85		2,319.03		14,374.88	
Fiscal year 1912.....		102,364.12		9,255.81		111,619.93	
Fiscal year 1913.....		235,738.81		8,751.46		244,490.27	
Fiscal year 1914.....		164,720.03		23,390.13		188,110.16	
Total to June 30, 1914.....		514,878.81		43,716.43		558,595.24	
Plant—Amount to be ab- sorbed after June 30, 1914.....		30,941.27				30,941.27	
Total.....		545,820.08		43,716.43		589,536.51	
POWER-TRANSMISSION SYSTEM.							
Transmission and duct lines:							
Fiscal year 1913.....		13,214.33		801.30		14,015.63	
Fiscal year 1914.....		1,222,745.02		104,914.16		1,327,659.18	
Total to June 30, 1914.....		1,235,959.35		105,715.46		1,341,674.81	
Transformer stations, fis- cal year 1914 (total).....		514,610.33		39,071.51		553,681.84	
Total power-trans- mission system.....		1,750,569.68		144,786.97		1,895,356.65	
Plant—Amount to be ab- sorbed after June 30, 1914.....		752.36				752.36	
Total.....		1,751,322.04		144,786.97		1,896,109.01	
Total miscellaneous construction.....		4,413,717.41		369,438.62		4,783,156.03	
General expenses, June, 1914.....				192,208.82		192,208.82	
Total construction costs.....		194,159,210.93		17,135,860.41		211,295,071.34	

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914.

TABLE 1A.—*Dredging excavation.*

ATLANTIC ENTRANCE.

Item.	July.		August.		September.		October.		November.		December.		January.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Operation, seagoing suction dredge.....	<i>Cu. yds.</i> 262,234	\$0.0376	<i>Cu. yds.</i> 259,807	\$0.0420	<i>Cu. yds.</i> 163,865	\$0.0536	<i>Cu. yds.</i> 189,001	\$0.0501	<i>Cu. yds.</i> 169,882	\$0.0609	<i>Cu. yds.</i> 221,474	\$0.0279	<i>Cu. yds.</i> 102,057	\$0.0462
Repairs, seagoing suction dredge.....	262,234	.0064	259,807	.0069	163,865	.0268	189,001	.0003	169,882	.0080	221,474	.0067	102,057	.4100
Operation, small-ladder dredges.....	21,106	.1246	38,730	.1347	48,365	.1213	32,760	.0771	.....	.....	.....	.....	.....	.....
Repairs, small-ladder dredges.....	21,106	.0463	38,730	.0463	48,365	.1213	32,760	.0699	.....	.....	.....	.....	.....	.....
Operation, small dipper dredges.....	66,192	.1014	13,979	.1185	2,539	.3009	20,659	.0839	.....	.....	.....	.....	.....	.....
Repairs, small dipper dredges.....	66,192	.0720	13,979	.5331	2,539	2.5251	20,659	.0685	.....	.....	.....	.....	.....	.....
Operation, pipe-line dredges.....	572,416	.0502	199,573	.0904	214,981	.0749	95,279	.0915	.....	.....	.....	.....	.....	.....
Repairs, pipe-line dredges.....	572,416	.0162	199,573	.0022	214,981	.0830	95,279	.0176	36,445	.1531	.....	.....	.....	.....
Operation, tugs, clapnets, and scows.....	87,298	.0824	52,709	.0633	50,904	.0988	53,419	.0594	36,445	.1838	.....	.....	.....	.....
Repairs, tugs, clapnets, and scows.....	87,298	.0722	52,709	.0566	50,904	.0683	53,419	.1363	.....	.....	.....	.....	.....	.....
Operation, miscellaneous floating equipment.....	921,948	.0016	512,089	.0022	429,750	.0011	337,699	.0135	206,327	.0217	221,474	.0005	102,057	.0037
Repairs, miscellaneous floating equipment.....	921,948	.0003	512,089	.0007	429,750	.0012	337,699	.0093	206,327	.0104	221,474	.0048	102,057	.0033
Blasting.....	69,341	.0018	24,459	.....	28,172	.....	28,161	.....	3,796	.....	.....	.....	.....	.....
Pipe lines.....	572,416	.0080	199,573	.0231	214,981	.0146	95,279	.0210	36,445	.0856	.....	.....	.....	.....
Channel lights.....	921,948	.....	512,089	.....	429,750	.....	337,699	.0004	206,327	.0020	221,474	.0017	102,057	.0123
Lockage.....	921,948	.....	512,089	.....	429,750	.....	337,699	.....	206,327	.....	221,474	.....	102,057	.....
Plant arbitrary.....	921,948	.0482	512,089	.0482	429,750	.0482	337,699	.0482	206,327	.0482	221,474	.0482	102,057	.....
Division expense.....	921,948	.0060	512,089	.0076	429,750	.0042	337,699	.0045	206,327	.0055	221,474	.0024	102,057	.0045
Total division cost.....	921,948	.1497	512,089	.1743	429,750	.2444	337,699	.1956	206,327	.1956	221,474	.1324	102,057	.4710
Administrative and general expenses.....	921,948	.0107	512,089	.0150	429,750	.0152	337,699	.0225	206,327	.0281	221,474	.0191	102,057	.0145
Total cost.....	921,948	.1604	512,089	.1893	429,750	.2596	337,699	.2181	206,327	.2237	221,474	.1515	102,057	.4855
Earth excavation.....	852,607	92.48	487,600	95.22	401,578	93.44	309,538	91.66	202,531	98.16	221,474	100.00	102,057	100.00
Rock excavation.....	69,341	7.52	24,459	4.78	28,172	6.56	28,161	8.34	3,796	1.84	.....	.....	.....	.....

NOTE.—Bold-face type indicates credit.

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.

TABLE 1A.—Dredging excavations—Continued.

ATLANTIC ENTRANCE—Continued.

Item.	February.		March.		April.		May.		June.		Total.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Operation, seagoing suction dredge.	<i>Cu. yds.</i> 289,396	\$0.0386	<i>Cu. yds.</i> 259,615	\$0.0711	<i>Cu. yds.</i> 186,119	\$0.0673	<i>Cu. yds.</i> 138,581	\$0.0881	<i>Cu. yds.</i> 100,982	\$0.0609	<i>Cu. yds.</i> 2,343,013	\$0.0516
Repairs, seagoing suction dredge.	289,396	.0135	259,615	.0045	186,119	.0208	138,581	.0037	100,982	.0150	2,343,013	.0258
Operation, small-ladder dredges.											140,961	.1163
Repairs, small-ladder dredges.											140,961	.1249
Operation, small dipper dredges.											103,369	.1051
Repairs, small dipper dredges.											103,369	.2696
Operation, pipe-line dredges.											1,118,694	.0690
Repairs, pipe-line dredges.											1,118,694	.0279
Operation, tugs, clapnets, and scows.											244,330	.0773
Repairs, tugs, clapnets, and scows.											244,330	.0831
Operation, miscellaneous floating equipment.	289,396	.0027	259,615	.0019	186,119	.0011	138,581	.0004	100,982	.0006	3,706,037	.0014
Repairs, miscellaneous floating equipment.	289,396	.0016	259,615	.0038	186,119	.0017	138,581	.0008	100,982	.0011	3,706,037	.0028
Blasting.											153,959	
Pipe lines.											1,118,694	.0164
Channel lights.	289,396	.0016	259,615	.0016	186,119	.0018	138,581	.0007	100,982	.0012	3,706,037	.0010
Lockage.	289,396		259,615		186,119		138,581		100,982		3,706,037	
Plant arbitrary.											2,629,287	.0482
Division expense.	289,396	.0041	259,615	.0070	186,119	.0039	138,581	.0072	100,982	.0080	3,706,037	.0055
Total division cost.	289,396	.0513	259,615	.0704	186,119	.0836	138,581	.0917	100,982	.1094	3,706,037	.1589
Administrative and general expenses.	289,396	.0046	259,615	.0080	186,119	.0163	138,581	.0134	100,982	.0101	3,706,037	.0142
Total cost.	289,396	.0559	259,615	.0784	186,119	.0999	138,581	.1051	100,982	.1195	3,706,037	.1731
Earth excavation.	289,396		259,615		186,119		138,581		100,982		3,552,078	95.85
Rock excavation.											153,959	4.15

NOTE.—Bold-face type indicates credit.

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.

TABLE 1B.—*Dredging excavation.*

GATUN LAKE.

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EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.
TABLE 1c.—Dredging excavation.
CULEBRA CUT.

Item.	October.		November.		December.		January.		February.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Clearing.....	Cubic yards. 60,370	\$0.0013	Cubic yards. 199,194	\$0.1278	Cubic yards. 434,202	\$0.0907	Cubic yards. 445,222	\$0.1930	Cubic yards. 432,786	\$0.2583
Operation, small ladder dredges.....	35,570	.1276	108,430	.0540	127,692	.1107	70,149	.0644	54,802	.2485
Repairs, small ladder dredges.....	35,570	.1273	108,430	.0540	127,692	.1107	70,149	.0644	54,802	.2485
Operation, 3-yard ladder dredges.....					110,932	.0388	108,557	.0816	90,761	.1135
Repairs, 3-yard ladder dredges.....					110,932	.0487	108,557	.0796	90,761	.1547
Operation, small dipper dredges.....	20,995	.1319	88,550	.0919	121,778	.0798	135,268	.0774	164,691	.0896
Repairs, small dipper dredges.....	20,995	.1151	88,550	.1265	121,778	.0993	135,268	.0789	164,691	.0590
Operation, large dipper dredges.....										
Repairs, large dipper dredges.....										
Operation, pipe-line dredges ¹	3,805	1.3397	2,214	1.3896	73,800	.1297	131,248	.1025	122,532	.1271
Repairs, pipe-line dredges ¹	3,805	2.1400	2,214	.5978	73,800	.0840	131,248	.0406	122,532	.0650
Operation, pipe-line dredges ²							58,409	.0810	39,900	.1462
Repairs, pipe-line dredges ²							58,409	.0304	39,900	.0403
Operation, tugs and clapsnets.....	56,565	.1166	196,980	.0957	360,402	.0960	316,363	.1245	321,904	.1292
Repairs, tugs and clapsnets.....	56,565	.0493	196,980	.0306	360,402	.0430	316,363	.0740	321,904	.1137
Operation, drill barges.....										
Repairs, drill barges.....										
Operation, miscellaneous floating equipment.....	60,370	.0075	199,194	.0149	434,202	.0099	445,222	.0118	432,786	.0164
Repairs, miscellaneous floating equipment.....	60,370	.0017	199,194	.0062	434,202	.0044	445,222	.0082	432,786	.0074
Drilling.....	44,427		151,602		302,507		325,766		335,005	.0057
Blasting.....	44,427		151,602		302,507	.0011	325,766	.0012	335,005	.0112
Pipe lines.....	3,805	.4250	2,214	.0762	73,800	.0448	128,859	.0353	110,882	.0555
Dikes.....	3,805		2,214		73,800		128,859		110,882	.0124
Operation, relay pumps.....	3,805	.5755	2,214	.1390	73,800	.0638	128,859	.0397	110,882	.0559
Repairs, relay pumps.....	3,805	.0080	2,214	.0530	73,800	.0006	128,859	.0037	110,882	.0074
Channel lights.....	60,370		199,194	.0015	434,202	.0010	445,222	.0011	432,786	.0007
Ditching.....	60,370		199,194		434,202		445,222		432,786	.0004
Lockage.....	60,370	.0108	199,194	.0009	434,202	.0006	445,222	.0005	432,786	.0005
Moving span bridge 57½.....	60,370	.0015	199,194		434,202	.0003	445,222	.0005	432,786	.0001
Flumes.....							60,798	.0614	51,550	.0144
Plant arbitrary.....	60,370	.0532	199,194	.0506	434,202	.0516	445,222	.0738	432,786	.0770
Division expense.....	60,370	.0231	199,194	.0249	434,202	.0158	445,222	.0199	432,786	.0195
Total division cost.....	60,370	.7735	199,194	.4172	434,202	.4007	445,222	.4709	432,786	.5948
Administrative and general expense.....	60,370	.0336	199,194	.0239	434,202	.0225	445,222	.0471	432,786	.0476
Total cost.....	60,370	.8071	199,194	.4711	434,202	.4232	445,222	.5180	432,786	.6424
Earth excavation.....	15,943	26.41	47,592	23.89	131,695	30.33	119,456	26.83	97,781	22.59
Rock excavation.....	44,427	73.59	151,602	76.11	302,507	69.67	325,766	73.17	335,005	77.41

Item.	March.		April.		May.		June.		Total.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Clearing.....	<i>Cubic yards.</i> 376, 809	\$. 2265	<i>Cubic yards.</i> 479, 646	\$. 2039	<i>Cubic yards.</i> 474, 131	\$. 2131	<i>Cubic yards.</i> 530, 003	\$. 2851	<i>Cubic yards.</i> 3, 432, 363	\$. 1629
Operation, small ladder dredges.....	48, 848	. 1147	33, 917	. 0839	13, 722	. 4926	13, 756	. 3012	506, 886	. 1223
Repairs, small ladder dredges.....	48, 848	. 1147	33, 917	. 0839	13, 722	. 4926	13, 756	. 3012	506, 886	. 1223
Operation, 3-yard ladder dredges.....	165	3. 9359	92, 906	. 0608	119, 924	. 0824	125, 838	. 0715	649, 083	. 0843
Repairs, 3-yard ladder dredges.....	165	3. 9359	92, 906	. 0608	119, 924	. 0824	125, 838	. 0715	649, 083	. 0843
Operation, small dipper dredges.....	208, 460	. 0617	169, 859	. 0707	134, 057	. 0923	101, 398	. 0817	1, 145, 056	. 0770
Repairs, small dipper dredges.....	208, 460	. 0617	169, 859	. 0707	134, 057	. 0923	101, 398	. 0817	1, 145, 056	. 0770
Operation, large dipper dredges.....	119, 336	. 0751	32, 805	. 0926	108, 185	. 0728	193, 011	. 0791	334, 001	. 0826
Repairs, large dipper dredges.....	119, 336	. 0751	32, 805	. 0926	108, 185	. 0728	193, 011	. 0791	334, 001	. 0826
Operation, pipe-line dredges ¹	119, 336	. 0989	150, 159	. 0550	98, 243	. 0749	96, 000	. 0530	797, 337	. 0959
Repairs, pipe-line dredges ¹	119, 336	. 0989	150, 159	. 0550	98, 243	. 0749	96, 000	. 0530	797, 337	. 0959
Operation, pipe-line dredges ²	44, 230	. 0114	44, 956	. 0204	5, 750	. 0822	193, 245	.....	193, 245	. 1149
Repairs, pipe-line dredges ²	44, 230	. 0114	44, 956	. 0204	5, 750	. 0822	193, 245	.....	193, 245	. 1149
Operation, tugs and claptets.....	270, 143	. 1430	336, 971	. 1148	376, 638	. 1044	434, 003	. 0958	2, 669, 969	. 1121
Repairs, tugs and claptets.....	270, 143	. 1430	336, 971	. 1148	376, 638	. 1044	434, 003	. 0958	2, 669, 969	. 1121
Operation, drill barges.....	376, 809	. 0150	479, 646	. 0088	474, 131	. 0096	530, 003	. 0097	3, 432, 363	. 0064
Repairs, miscellaneous floating equipment.....	376, 809	. 0086	479, 646	. 0037	474, 131	. 0076	530, 003	. 0080	3, 432, 363	. 0064
Drilling.....	261, 091	. 0099	296, 638	. 0068	359, 301	. 0068	436, 371	. 0038	2, 512, 708	. 0146
Blasting.....	261, 091	. 0124	296, 638	. 0095	359, 301	. 0120	436, 371	. 0007	2, 512, 708	. 0149
Pipe lines.....	106, 666	. 0822	142, 675	. 0217	97, 493	. 0111	96, 000	. 0147	762, 394	. 0410
Dikes.....	106, 666	. 0152	142, 675	. 0014	97, 493	.....	96, 000	.....	762, 394	. 0042
Operation, relay pumps.....	106, 666	. 0671	142, 675	. 0480	97, 493	. 0539	96, 000	. 0530	762, 394	. 0600
Repairs, relay pumps.....	106, 666	. 0061	142, 675	. 0011	97, 493	. 0075	96, 000	. 0124	762, 394	. 0055
Channel lights.....	376, 809	. 0011	479, 646	. 0006	474, 131	. 0006	530, 003	. 0006	3, 432, 363	. 0008
Ditching.....	376, 809	.....	479, 646	.....	474, 131	.....	530, 003	.....	3, 432, 363	. 0009
Lockage.....	376, 809	. 0007	479, 646	. 0003	474, 131	. 0002	530, 003	. 0008	3, 432, 363	. 0005
Moving span bridge 57½.....	376, 809	.....	479, 646	.....	474, 131	. 0204	530, 003	.....	3, 432, 363	. 0001
Flumes.....	376, 809	. 0032	52, 440	. 0015	6, 500	. 0204	530, 003	.....	228, 188	. 0184
Plant arbitrary.....	376, 809	. 0908	446, 859	. 0770	365, 946	. 0675	336, 992	. 0640	3, 098, 380	. 0707
Division expense.....	376, 809	. 0238	479, 646	. 0151	474, 131	. 0174	530, 003	. 0175	3, 432, 363	. 0189
Total division cost.....	376, 809	. 7240	479, 646	. 4626	474, 131	. 4427	530, 003	. 4708	3, 432, 363	. 5195
Administrative and general expense.....	376, 809	. 0701	479, 646	. 0484	474, 131	. 0560	530, 003	. 0318	3, 432, 363	. 0461
Total cost.....	376, 809	. 7941	479, 646	. 5110	474, 131	. 4987	530, 003	. 5026	3, 432, 363	. 5656
Earth excavation.....	115, 718	30. 71	183, 008	38. 15	114, 830	24. 22	93, 632	17. 67	919, 655	26. 79
Rock excavation.....	261, 091	69. 29	296, 638	61. 85	359, 301	75. 75	436, 371	82. 33	2, 512, 705	73. 21

NOTE.— Bold-face type indicates credit.

¹ Dredging.² Sluicing.

TABLE 1E.—*Dredging excavation.*
PACIFIC ENTRANCE.

Items.	July.		August.		September.		October.		November.		December.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Operation, seagoing suction dredges.	<i>Cubic yards.</i> 378, 733	\$0. 0957	<i>Cubic yards.</i> 433, 147	\$0. 0958	<i>Cubic yards.</i> 308, 655	\$0. 0952	<i>Cubic yards.</i> 229, 338	\$0. 0409	<i>Cubic yards.</i> 191, 682	\$0. 0496	<i>Cubic yards.</i> 129, 900	\$0. 0559
Repairs, seagoing suction dredges.	378, 733	.0041	433, 147	.0036	308, 655	.0114	229, 338	.0188	191, 682	.0183	129, 900	.1003
Operation, small ladder-dredges.	188, 136	.0606	135, 371	.0874	127, 180	.0697	39, 769	.1552	14, 433	.1944	3, 173	.2282
Repairs, small-ladder dredges.	188, 136	.0179	135, 371	.1139	127, 180	.0626	39, 769	.0907	14, 433	.1148	3, 173	.2607
Operation, 3-yard ladder dredges.	176, 574	.0501	136, 271	.0838	123, 639	.0700	146, 993	.0643	95, 039	.0819	.....	.....
Repairs, 3-yard ladder dredges.	176, 574	.0425	136, 271	.0181	123, 639	.0392	146, 993	.0353	95, 039	.1123	.....	.....
Operation, small-dipper dredges.	13, 487	.2137	21, 467	.1882	22, 484	.1577	16, 998	.2025	10, 396	.2015	11, 528	.1272
Repairs, small-dipper dredges.	13, 487	.2765	21, 467	.1895	22, 484	.1344	16, 998	.2149	10, 396	.3491	11, 528	.1932
Operation, tugs, claps, and scows.	378, 197	.0618	293, 109	.0810	273, 303	.0918	203, 760	.1046	119, 868	.1030	14, 701	.2953
Repairs, tugs, claps, and scows.	378, 197	.0301	293, 109	.0434	273, 303	.0689	203, 760	.1100	119, 868	.1228	14, 701	.1291
Operation, drill barge.	310, 052	.0327	260, 799	.0372	260, 712	.0342	168, 542	.0763	115, 602	.1309	9, 664	1. 5385
Repairs, drill barge.	310, 052	.0024	260, 799	.0019	260, 712	.0045	168, 542	.0122	115, 602	.0045	9, 664	.0497
Operation, rock breaker.	310, 052	.0036	260, 799	.0056	260, 712	.0048	168, 542	.0071	115, 602	.0099	9, 664	.1203
Repairs, rock breaker.	310, 052	.0024	260, 799	.0004	260, 712	.0004	168, 542	.0041	115, 602	.0059	9, 664	.1138
Operation, miscellaneous floating equip- ment.	756, 930	.0023	726, 256	.0018	581, 958	.0030	433, 098	.0069	311, 550	.0072	144, 601	.0054
Repairs, miscellaneous floating equip- ment.	756, 930	.0031	726, 256	.0029	581, 958	.0040	433, 098	.0046	311, 550	.0001	144, 601	.0062
Drilling.	310, 052	.0004	260, 799	.....	260, 712	.....	168, 542	.....	115, 602	.....	9, 664	.....
Blasting.	310, 052	.....	260, 799	.....	260, 712	.....	168, 542	.....	115, 602	.....	9, 664	.....
Channel lights.	756, 930	.....	726, 256	.....	581, 958	.....	433, 098	.0004	311, 550	.0003	144, 601	.0031
Lockages.	756, 930	.....	726, 256	.....	581, 958	.....	433, 098	.....	311, 550	.....	144, 601	.....
Moving span bridge No. 57½.	756, 930	.....	726, 256	.....	581, 958	.....	433, 098	.....	311, 550	.....	144, 601	.....
Plant arbitrary.	756, 930	.0234	726, 256	.0235	581, 958	.0244	433, 098	.0257	311, 550	.0282	144, 601	.0200
Division expense.	756, 930	.0050	726, 256	.0044	581, 958	.0043	433, 098	.0125	311, 550	.0130	144, 601	.0093
Total division cost.	756, 930	.1614	726, 256	.1838	581, 958	.2134	433, 098	.2944	311, 550	.3256	144, 601	.3859
Administrative and general expense.	756, 930	.0132	726, 256	.0160	581, 958	.0235	433, 098	.0325	311, 550	.0510	144, 601	.0811
Total cost.	756, 930	.1746	726, 256	.1998	581, 958	.2369	433, 098	.3269	311, 550	.3766	144, 601	.4670
Earth excavation. per cent..	446, 878	59. 04	465, 457	64. 09	321, 246	55. 20	264, 556	61. 08	195, 948	62. 89	134, 937	93. 32
Rock excavation. per cent..	310, 052	40. 96	260, 799	35. 91	260, 712	44. 80	168, 542	38. 92	115, 602	37. 11	9, 664	6. 68

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.

TABLE 1E.—*Dredging excavation*—Continued.

PACIFIC ENTRANCE—Continued.

Items.	January.		February.		March.		April.		May.		June.		Total.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
Operation, seagoing suction dredges.....	<i>Cubic yards.</i> 86,585	\$0.0658			<i>Cubic yards.</i>		<i>Cubic yards.</i>		<i>Cubic yards.</i>		<i>Cubic yards.</i> 29,202	\$0.0465	<i>Cubic yards.</i> 1,787,302	\$0.0346
Repairs, seagoing suction dredges.....	86,585	.1163	9,275	\$0.2132	13,720	\$0.2215	11,209		33,201		29,202	.0034	1,787,302	.0098
Operation, small-ladder dredges.	.....	.....	9,275	.2422	13,720	.0721	11,209		33,201		31,610	.0756	607,077	.0978
Repairs, small-ladder dredges.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31,610	.0998	607,077	.0805
Operation, 3-yard ladder dredges.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		678,516	.0881
Repairs, 3-yard ladder dredges.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		678,516	.0465
Operation, small-dipper dredges.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		96,360	.1746
Repairs, small-dipper dredges.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		96,360	.2111
Operation, tugs, clapnets, and scows.....	.....	.....	9,275	.2259	13,720	.1529	11,209	\$0.1496	33,201	\$0.1314	31,610	.0781	1,381,953	.1890
Repairs, tugs, clapnets, and scows.	.....	.....	9,275	.1476	13,720	.0750	11,209	.0662	33,201	.0205	31,610	.0411	1,381,953	.0630
Operation drill barge.....	.....	.....	9,275	1.0237	10,924	1.1141	8,286	1.1529	22,269	.4043	10,307	.6683	1,186,432	.1102
Repairs, drill barge.....	.....	.....	9,275	.1581	10,924	.0486	8,286	.0758	22,269	.0715	10,307	.0854	1,186,432	.0092
Operation, rock breaker.....	.....	.....	9,275	.1334	10,924	.1336	8,286	.1361	22,269	.0571	10,307	.1702	1,186,432	.0125
Repairs, rock breaker.....	.....	.....	9,275	.0481	10,924	.0827	8,286	.0856	22,269	.0034	10,307	.0082	1,186,432	.0053
Operation, miscellaneous float- ing equipment.....	86,585	.0068	9,275	.0061	13,720	.0062	11,209	.0026	33,201	.0108	60,872	.0051	3,169,255	.0039
Repairs, miscellaneous floating equipment.....	86,585	.0036	9,275	.0006	13,720	.0008	11,209	.0014	33,201	.0096	60,872	.0018	3,169,255	.0033
Drilling.....	.....	.....	9,275	.....	10,924	.....	8,286	.....	22,269	.....	10,307	.....	1,186,432	.0001
Blasting.....	.....	.....	9,275	.0060	10,924	.0048	8,286	.....	22,269	.....	10,307	.0031	1,186,432	.0001
Channel lights.....	86,585	.0335	9,275	.0710	13,720	.0327	11,209	.0361	33,201	.0069	60,872	.0013	3,169,255	.0017
Lockages.....	86,585	.....	9,275	.....	13,720	.0042	11,209	.0058	33,201	.0030	60,872	.0010	3,169,255	.0001
Moving span bridge No. 57½	86,585	.....	9,275	.....	13,720	.....	11,209	.0020	33,201	.....	60,872	.....	3,169,255	.....
Plant arbitrary.....	86,585	.0200	9,275	.0200	13,720	.0200	11,209	.0200	33,201	.0200	60,872	.0200	3,169,255	.0241
Division expense.....	86,585	.0181	9,275	.1346	13,720	.0976	11,209	.0432	33,201	.0296	60,872	.0174	3,169,255	.0085
Total division cost.....	86,585	.1960	9,275	2.4368	13,720	1.8505	11,209	1.9980	33,201	.9559	60,872	.3897	3,169,255	.2547
Administrative and general ex- pense.....	86,585	.0794	9,275	.3838	13,720	.2298	11,209	.3075	33,201	.0808	60,872	.0419	3,169,255	.0313
Total cost.....	86,585	.2754	9,275	2.8206	13,720	2.0803	11,209	2.3055	33,201	1.0367	60,872	.4316	3,169,255	.2860

Earth excavation.....per cent..	86,585	100.00	.....	2,796	20.38	2,923	26.08	10,932	32.93	50,565	83.07	1,982,823	62.56
Rock excavation.....per cent..	.....	.....	.....	10,924	79.62	8,286	73.92	22,269	67.07	10,307	16.93	1,186,432	37.44

NOTE.—Bold-face type indicates credit.

TABLE 2.—*Hydraulic excavation.*

CENTRAL DIVISION.

Item.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
GOLD HILL.													
Quantities.....cubic yards..	112,900	83,200	150,400	105,900	81,400	141,000	153,500	132,900	122,800	110,230	86,350	103,875	1,384,455
Drilling.....	.....	.....	\$0.0002	.....	.....	\$0.0019	\$0.0038	\$0.0013	\$0.0009	\$0.0007	\$0.0013	\$0.0007	\$0.0010
Blasting.....	.....	\$0.0001	.0003	\$0.0001	.....	.0026	.0017	.0032	.0052	.0119	.0170	.0004	.0033
Pump station.....	\$0.0399	.0484	.0274	.0339	\$0.0505	.0299	.0140	.0360	.0370	.0538	.0555	.0374	.0374
Pipe lines and monitors.....	.0162	.0200	.0094	.0351	.0251	.0179	.0239	.0202	.0225	.0224	.0164	.0152	.0186
Flumes.....	.0221	.0368	.0265	.....	.0407	.0153	.0308	.0179	.0146	.0243	.0172	.0205	.0245
Relay pumps.....	.....	.....	.....	.....	.0079	.0294	.0332	.0313	.0637	.0692	.0907	.0393	.0314
Maintenance of equipment.....	.0227	.0277	.0195	.0274	.0372	.0157	.0169	.0223	.0192	.0136	.0292	.0169	.0214
Plant arbitraries.....	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.0539
Division expense.....	.0067	.0094	.0137	.0191	.0182	.0041	.0057	.0118	.0001	.0037	.0047	.0029	.0082
Total division cost.....	.2076	.2424	.1970	.2518	.2796	.2168	.1400	.1540	.1732	.2096	.2420	.1539	.1997
Administrative and general expense.....	.0054	.0204	.0091	.0178	.0288	.0151	.0150	.0438	.0203	.0190	.0321	.0162	.0196
Total cost.....	.2130	.2628	.2061	.2696	.3084	.2319	.1550	.1978	.1935	.2286	.2741	.1701	.2193

TABLE 3.—*Breakwaters.*

Items.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Quantities.....cubic yards..	23,772	24,026	23,467	25,990	21,489	18,595	17,888	16,678	21,220	14,529	.....	.....	207,654
Colon west breakwater quarrying Porto Bello, large rock:													
Stripping.....	\$0.0744	\$0.3179	\$0.3272	\$0.3161	\$0.0535	\$0.7067	\$0.4104	\$0.3963	\$0.2597	\$0.2900	.....	.....	\$0.3045
Drilling.....	.0850	.0724	.0728	.0802	.0846	.0838	.1077	.0825	.0665	.0691	.....	.....	.0802
Blasting.....	.2630	.1602	.2369	.1597	.2269	.1573	.1666	.1253	.1648	.1253	.....	.....	.1817
Loading.....	.2226	.1369	.1479	.1265	.2572	.0153	.0943	.1240	.1088	.1175	.....	.....	.1365

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.

TABLE 3.—Breakwaters—Continued.

Items.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Colon west breakwater quarrying Porto Bello, large rock—Continued.													
Transportation.....	\$0.2738	\$0.1730	\$0.1586	\$0.1543	\$0.3340	\$0.0209	\$0.1255	\$0.1648	\$0.1462	\$0.1193			\$0.1685
Tracks.....	.2018	.1286	.1702	.2796	.1296	.1780	.2222	.1862	.1475				.1802
Loading on barges.....	.1598	.1700	.1790	.1754	.1998	.1710	.1561	.1556	.1071	.1540			.1638
Power.....	.1016	.0960	.1008	.0936	.0983	.1143	.1119	.1096	.0908	.1982			.1015
Maintenance of equipment.....	.3855	.6504	.5198	.4718	.4329	.5846	.7649	.7732	.1810	.1066			.4859
Plant arbitrary.....	.6523	.6523	.6523	.6523	.6523	.6523	1.5846	1.5838	1.5842	(*)			.8570
Total.....	2.4198	2.5577	2.5654	2.5095	2.4691	2.5718	3.7351	3.7408	2.8584	1.2249			2.6598
Towing:													
Operation of tugs and barges.....	.1770	.2493	.1120	.1491	.2384	.2450	.2405	.2686	.2132	.2625			.1999
Maintenance of equipment.....	.1879	.2956	.1597	.1221	.2142	.1362	.1390	.0359	.1048	.0405			.1519
Plant arbitrary.....	.7758	.7758	.7758	.7758	.7758	.7758	1.8369	1.8369	1.8369	(*)			1.0066
Total.....	1.1407	1.3207	1.0475	1.0470	1.2284	1.1570	2.2164	2.1414	2.1549	.3030			1.3584
Placing:													
Operation of floating derricks.....	.2368	.1873	.2700	.2692	.2506	.4424	.3470	.4425	.3273	.5506			.3281
Maintenance of floating derricks.....	.0456	.1175	.1402	.1151	.2521	.1348	.0915	.0819	.0760	.0718			.1388
Operation of cranes.....	.1069	.0872	.0732	.0824	.1146	.0092	.0188	.0221	.0189	.0172			.0607
Operation of trains.....	.0388	.0388	.0347	.0432	.0542	.0043	.0016	.0016	.0021	.0020			.0249
Dumping.....	.0094	.0100	.0060	.0101	.0089	.0007	.....	.....	.0001	.....			.0052
Maintenance of equipment.....	.0547	.0638	.0595	.0826	.1349	.0435	.0120	.0181	.0030	.0378			.0532
Plant arbitrary.....	.2748	.2748	.2748	.2748	.2748	.2748	.6507	.6507	.6507	(*)			.3564
Total.....	.7670	.7794	.8584	.8774	1.0901	.9097	1.1216	1.2169	1.0721	.6794			.9673
Trestles.....	.0759	.0536	.0345	.0367	.0376	.0098	.0033	.0012	.0007	.0007			.0288
Tug service, miscellaneous.....	.0355	.0471	.0487	.0589	.0647	.0977	.0673	.1150	.0812	.1221			.0702
Maintenance of equipment, miscella-neous.....	.0068	.1049	.0102	.0032	.0426	.0344	.0727	.0090	.0229	.0110			.0321
Division expense.....	.1722	.1691	.2874	.0918	.2222	.3410	.3970	.1546	.2486	.0984			.2169
Total division cost.....	4.6179	5.0325	4.8521	4.6245	5.1547	5.1214	7.6134	7.3789	6.4388	2.4395			5.3335
Administrative and general expense.....	.2830	.2854	.4450	.6943	.7114	.5824	.6346	.9860	.4072	.7108			.5764
Total cost, large rock.....	4.9009	5.3179	5.2971	5.3188	5.8661	5.7038	8.2480	8.3649	6.8460	3.1503			5.9099

(*) Plant arbitrary not included account final plant adjustment. The quarry was closed on Apr. 30, 1914.
NOTE.—Bold-face type indicates credit.

TABLE 4.—Stone production—Ancon quarry.

Item.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.	Total.
Quantities.....cubic yards.	31,932	43,850	35,209	53,379	38,537	43,153	50,789	47,127	44,212	36,843	29,473	42,875	502,798
Quarrying:													
Stripping.....	\$0.0524	\$0.0082	\$0.0068	\$0.0093	\$0.0018	\$0.0008	\$0.0006	\$0.0381	\$0.0058	\$0.0426	\$0.0597	\$0.0006	\$0.0064
Drilling.....	.0336	.0844	.0510	.0949	.0993	.0976	.0659	.0722	.0483	.0314	.1271	.0349	.0645
Blasting.....	.0611	.0863	.0863	.0267	.0614	.0832	.0149	.0722	.0360	.0344	.0659	.0278	.0553
Loading.....	.0743	.0746	.0597	.0596	.0646	.0678	.0586	.0650	.0404	.0861	.1009	.0290	.0564
Transportation.....	.1395	.0885	.0597	.0752	.0944	.0694	.0586	.0679	.0794	.0395	.0422	.0724	.0793
Tracks.....	.0325	.0390	.0270	.0535	.0310	.0327	.0249	.0340	.0431	.0345	.0811	.0163	.0345
Maintenance of equipment.....	.1911	.0578	.0761	.0275	.0411	.0773	.0536	.0670	.0643	.0729	.0811	.0441	.0665
Plant arbitrary.....	.0800	.0800	.0800	.0800	.0800	.0854	.1500	.1628	.1450	.1500	.1500	.1500	.1153
Total.....	.6845	.4043	.4643	.4267	.4736	.5142	.4149	.4846	.4823	.4769	.6269	.3751	.4782
Crushing:													
Operation crushers.....	.0491	.0480	.0308	.0297	.0401	.0375	.0322	.0385	.0290	.0349	.0365	.0417	.0366
Stone bins and conveyors.....	.0052	.0054	.0060	.0047	.0054	.0154	.0046	.0050	.0057	.0064	.0076	.0044	.0053
Power.....	.0193	.0192	.0260	.0097	.0135	.0123	.0114	.0127	.0198	.0254	.0244	.0252	.0174
Maintenance of equipment.....	.1781	.0407	.2892	.0538	.1394	.0867	.0316	.0503	.0676	.0409	.1655	.0893	.0831
Plant arbitrary.....	.0300	.0300	.0300	.0300	.0300	.0320	.1000	.1085	.0966	.1000	.1000	.1000	.0653
Total.....	.2817	.1433	.3820	.1279	.2284	.1739	.1798	.2150	.2187	.2076	.3340	.2606	.2177
Rail transportation to storage:													
Operation of trains.....	.0451	.0343	.0177	.0148	.0806	.0489	.0546	.0527	.0664	.0824	.0944	.0595	.0520
Dumping in storage.....	.0252	.0093	.0187	.0067	.0014	.0040	.0142	.0292	.0025	.....	.....	.0092	.0101
Maintenance of equipment.....	.0311	.0103	.0098	.0020	.0206	.0437	.0292	.0432	.0293	.0463	.0506	.0363	.0231
Plant arbitrary.....	.0400	.0400	.0400	.0400	.0400	.0427	.1000	.1085	.0966	.1000	.1000	.1000	.0703
Total.....	.1414	.0939	.0862	.0635	.1426	.1393	.1980	.2336	.1948	.2287	.2450	.2050	.1605
Quantities.....cubic yards.										3,018	5,300	494	8,812
Loading from storage pile:													
Loading.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tracks.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maintenance of equipment.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Division expense.....	.0518	.0357	.1252	.0681	.0426	.0155	.0147	.0267	.0132	.0082	.0374	.0175	.0365
Total cost.....	1.1594	.7672	1.0577	.6862	.8872	.8429	.8074	.9599	.9090	.9483	1.2851	.8594	.8974

NOTE.—Under "Total" 5,419 cubic yards have been added to adjust difference between cross-section measurements of stock pile and book balance. This amount was not added to monthly quantities.

EXHIBIT B.—DETAILED COST PER UNIT OF WORK, BY MONTHS, FISCAL YEAR 1914—Continued.

TABLE 5.—*Sand production—Chame.*

Item.	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	April.	May.	June.	Total.
Quantities.....cubic yards.....	25,767	19,921	19,407	25,952	21,021	18,561	24,380	9,633	3,150	18,330	21,140	199,319
Dredging:												
Operation, dredges.....	\$0.1185	\$0.1472	\$0.1499	\$0.1176	\$0.1300	\$0.1279	\$0.0976	\$0.0779	\$0.2915	\$0.1531	\$0.1232	\$0.1331
Maintenance of equipment.....	.0134	.0740	.0254	.0600	.0441	.1917	.0410	.0867	.2429	.0842	.0356	.0664
Plant arbitrary.....	.0040	.0040	.0040	.0040	.0040	.0077	.....	.....	.....	.....	.....	.0030
Total cost of construction.....	.1359	.2252	.1793	.1816	.1781	.3273	.1386	.1646	.5344	.2373	.1588	.2025
Quantities.....cubic yards.....	25,767	19,921	19,407	25,952	21,021	18,561	24,380	9,633	3,150	18,330	21,140	199,319
Towing:												
Operation, tugs and barges.....	\$0.1360	\$0.1480	\$0.1494	\$0.1634	\$0.1640	\$0.1306	\$0.1336	\$0.0987	\$0.4432	\$0.1129	\$0.2519	\$0.1636
Maintenance of equipment.....	.0564	.0554	.0258	.0184	.1057	.1099	.0316	.5560	.0898	.0200	.0844	.0854
Total.....	.1924	.2034	.1752	.1818	.2697	.2405	.1652	.6547	.5330	.1329	.3363	.2490
Quantities.....cubic yards.....	25,767	19,921	19,407	25,952	21,021	18,561	23,980	8,133	3,150	18,330	21,140	197,399
Unloading:												
Operation, cableways and cranes.....	\$0.1402	\$0.1232	\$0.1119	\$0.0807	\$0.0777	\$0.1216	\$0.1019	\$0.1213	\$0.0137	\$0.0792	\$0.0911	\$0.1069
Power.....	.0056	.0027	.0039	.0034	.0055	.0044	.0030	.0021	.....	.....	.0198	.0056
Maintenance of equipment.....	.0432	.0459	.0375	.0375	.0200	.0137	.0079	.0725	.0344	.0491	.0218	.0378
Plant arbitrary.....	.0200	.0200	.0200	.0200	.0200	.0387	.....	.....	.....	.....	.....	.0150
Total.....	.2090	.2037	.1817	.1416	.1232	.1784	.1128	.1959	.0481	.1283	.1327	.1653
Quantities.....cubic yards.....	25,767	19,921	19,407	25,952	21,021	18,561	23,980	8,133	3,150	18,330	21,140	197,399
Rail transportation to storage:												
Operation of trains.....	\$0.0434	\$0.0368	\$0.0125	\$0.0313	\$0.0556	\$0.0436	\$0.0127	\$0.1331	\$0.5250	\$0.1440	\$0.1023	\$0.0788
Repairs to tracks.....	.0006	.0005	.0004	.....	.0090	.....	.0080	.....	.....	.0650	.....	.0015
Dumping in storage.....	.0434	.0253	.0402	.0069	.0220	.0456	.0194	.0148	.....	.....	.....	.0227
Maintenance of equipment.....	.0296	.0123	.0074	.0077	.0146	.0390	.1222	.1074	.3054	.....	.0621	.0535
Plant arbitrary.....	.0100	.0100	.0100	.0100	.0100	.0193	.....	.....	.....	.....	.....	.0075
Total.....	.1270	.0849	.0705	.0559	.1112	.1475	.1873	.2553	.8304	.2090	.1644	.1640
Quantities.....cubic yards.....	.....	.....	.....	.....	.....	.....	.....	.....	24,306	19,852	.....	44,158

[illegible]

NOTE.—Under "Total," 7,943 cubic yards have been deducted to adjust difference between cross-section measurements of stock pile and book balance. This amount was not added to monthly quantities. No sand was produced in March, 1914.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914.

TABLE 1.—*Spillway gates and machinery, lock gates, emergency dams, chain fenders, and hydroelectric power plant.*

	Amount.		
	Gatun.	Pedro Miguel.	Miraflores.
Spillway gates and caissons:			
Gates—			
Payments to contractor.....	\$49,509.20	.....	\$30,639.00
Installation.....	34,844.59	.....	11,781.72
Total gates.....	84,353.79	.....	42,420.72
Caissons—			
Payments to contractor.....	5,690.00	.....	5,690.00
Installation.....	635.31	.....	1,109.05
Total caissons.....	6,325.31	.....	5,799.05
Administrative and general expense.....	5,102.18	.....	1,321.46
Total, spillway gates and caissons.....	95,781.28	.....	49,541.23
Spillway-gate machines:			
Inspection.....	2,036.10	.....	379.20
Testing.....	1,289.29	.....	871.90
Original cost of machinery.....	78,229.66	.....	77,667.38
Installation, mechanical and electrical.....	21,495.63	.....	28,110.11
Cleaning up.....	80.95	.....	594.36
Total division cost, spillway-gate machines.....	103,131.63	.....	107,622.95
Administrative and general expense.....	3,701.19	.....	4,827.56
Total cost, spillway-gate machines.....	106,832.82	.....	112,450.51
Lock gates:			
Inspection.....	90,676.03	\$59,318.37	49,479.81
Payments to contractor ¹	2,368,173.08	1,574,355.21	1,690,414.09
Other expenses.....	332,714.38	149,320.39	157,355.63
Total division cost, lock gates.....	2,791,563.49	1,782,993.97	1,897,249.53
Administrative and general expense.....	75,597.61	14,112.37	26,265.20
Total, lock gates.....	2,867,161.10	1,797,106.34	1,923,514.73
Fender chains:			
Inspection.....	2,110.00	316.65	266.68
Testing.....	576.93	.....	.....
Installation.....	4,458.15	6,084.71	.....
Total division cost, fender chains.....	7,145.08	6,401.36	266.68
Administrative and general expense.....	27.51	27.36	27.25
Total cost, fender chains.....	7,172.59	6,428.72	293.93
Emergency dams:			
Inspection.....	43,582.42	30,269.15	27,059.97
Payments to contractor.....	640,123.54	747,870.09	570,336.27
Other expenses.....	78,132.66	29,703.82	39,906.75
Total division cost, emergency dams.....	761,838.62	807,843.06	637,302.99
Administrative and general expense.....	7,799.04	2,379.63	4,500.62
Total cost, emergency dams.....	769,637.66	810,222.69	641,803.61
Hydroelectric power house, Gatun:			
Building.....	328,457.08	.....	.....
Equipment—			
Inspection.....	2,228.66	.....	.....
Testing.....	3,474.62	.....	.....
Original cost of equipment.....	208,657.40	.....	.....
Installation.....	85,789.23	.....	.....
Cleaning up.....	105.69	.....	.....
Total cost of equipment.....	300,255.60	.....	.....
Total division cost, hydroelectric power house.....	628,712.68	.....	.....
Administrative and general expense.....	44,849.00	.....	.....
Total cost, hydroelectric power house.....	673,561.68	.....	.....

¹ Includes lock-gate spare parts at Pedro Miguel.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 2.—Locks operating machinery.

	Amount.		
	Gatun.	Pedro Miguel.	Miraflores.
Operating machinery:			
Inspection.....	\$75,129.47	\$33,654.64	\$59,141.95
Testing.....	47,898.42	15,717.90	10,647.43
Cleaning up.....	22,117.00	16,057.82	36,266.89
Miter-gate machines:			
Miter gate moving machines, mechanical—			
Number of machines.....	40	24	28
Original cost of machinery.....	\$313,311.51	\$184,123.46	\$207,309.81
Mechanical installation.....	55,685.85	29,673.42	32,305.98
Total miter gate moving machines, mechanical.....	368,997.36	213,796.88	239,615.79
Average cost per machine.....	9,224.93	8,908.20	8,557.71
Miter forcing machines, mechanical—			
Number of machines.....	20	12	14
Original cost of machinery.....	\$17,671.11	\$10,464.01	\$12,090.76
Mechanical installation.....	7,488.32	3,778.47	5,707.49
Total miter gate forcing machines, mechanical.....	25,159.43	14,242.48	17,798.25
Average cost per machine.....	1,257.98	1,186.88	1,271.30
Handrail machines, mechanical—			
Number of machines.....	40	24	28
Original cost of machinery.....	\$5,289.85	\$2,791.95	\$8,906.78
Mechanical installation.....	5,893.93	1,717.36	4,962.45
Total handrail machines, mechanical.....	11,183.78	4,509.31	13,959.23
Average cost per machine.....	279.59	187.89	498.54
Gate sump pumps, mechanical—			
Number of machines.....	40	24	28
Original cost of machinery.....	\$7,433.21	\$3,819.68	\$7,727.09
Mechanical installation.....	3,497.72	2,268.09	3,770.52
Total handrail machines, mechanical.....	10,930.93	6,087.77	11,497.61
Average cost per machine.....	273.27	253.66	410.63
Electrical—			
Number of sets of machines.....	40	24	28
Original cost of machinery.....	\$58,513.88	\$26,447.98	\$47,364.14
Installation.....	34,874.09	16,428.39	24,024.94
Total electrical installation.....	93,387.97	42,876.37	71,389.08
Average cost per machine.....	2,334.70	1,786.51	2,549.61
Total miter-gate machines.....	509,659.47	281,512.81	354,259.96
Rising stem valves:			
Number of valves.....	62	30	42
Original cost of valves.....	\$123,228.65	\$61,449.64	\$95,347.09
Mechanical installation.....	62,575.39	39,070.80	66,461.01
Total rising-stem valves.....	185,804.04	100,520.44	161,808.10
Average cost per valve.....	2,996.84	3,350.68	3,852.57
Rising stem valve machines:			
Number of machines.....	62	30	42
Original cost of machinery.....	\$407,289.05	\$171,404.02	\$269,006.93
Installation, mechanical and electrical.....	93,312.04	57,982.03	61,608.94
Total rising stem valve machines.....	500,601.09	229,386.05	330,615.78
Average cost per machine.....	8,074.21	7,646.20	7,871.81

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 2.—Locks operating machinery—Continued.

	Amount.		
	Gatun.	Pedro Miguel.	Miraflores.
Cylindrical valves:			
Number of valves.....	60	20	40
Adjustment ¹	\$7,177.10	\$3,313.45	\$11,269.75
Average cost per valve.....	119.62	165.68	281.74
Cylindrical valve machines:			
Number of machines.....	60	20	40
Original cost of machines.....	79,940.34	31,611.02	49,739.43
Installation, mechanical and electrical.....	23,167.84	8,758.55	13,244.56
Total cylindrical valve machines.....	103,108.18	40,369.57	62,983.99
Average cost per machine.....	1,718.47	2,018.48	1,574.60
Auxiliary culvert valve machines:			
Number of machines.....	4	4	4
Original cost of machines.....	5,401.82	5,384.74	5,276.28
Installation, mechanical and electrical.....	1,787.51	2,000.62	2,954.83
Total auxiliary culvert valve machines.....	7,189.33	7,385.36	8,231.11
Average cost per machine.....	1,797.31	1,846.34	2,057.78
Chain fender machinery: ²			
Number of machines.....	16	16	16
Original cost of machines.....	209,536.04	218,797.65	232,804.61
Installation, mechanical and electrical.....	66,420.91	47,800.13	55,365.55
Total cost chain fender machines.....	275,956.95	266,597.78	288,170.16
Average cost per machine.....	17,247.31	16,662.36	18,010.64
Culvert pumps:			
Number of pumps.....	1	1	1
Original cost of pumps.....	2,808.92	2,903.91	2,903.92
Installation, mechanical and electrical.....	632.34	2,781.27	715.78
Total cost culvert pumps.....	3,441.26	5,685.18	3,619.70
Drainage sump pumps:			
Number of pumps.....	3	3	3
Original cost of pumps.....		953.09	44.10
Installation, mechanical and electrical.....	1,606.89	481.05	951.85
Total cost of pumps.....	1,606.89	1,434.14	995.95
Average cost per pump.....	535.63	478.05	331.98
Electric locomotives:			
Number of locomotives.....	7	8	6
Original cost of locomotives.....	92,317.14	105,437.02	79,019.90
Testing and erecting.....	11,799.06	4,229.89	6,300.45
Total cost of locomotives.....	104,116.20	109,666.91	85,320.35
Average cost per locomotive.....	14,873.74	13,708.36	14,220.06
Test locomotive returned to General Electrical Co.....	25,085.15		
Total.....	129,201.35		
Equipment for transformer rooms:			
Number of rooms.....	17	9	13
Original cost of equipment.....	112,651.32	43,943.90	90,354.42
Installation.....	40,443.76	36,476.96	33,491.74
Total cost equipment.....	153,095.08	80,420.86	123,846.16
Average cost per room.....	9,005.59	8,935.66	9,526.63

¹ Original cost and installation of valves included in "Locks, ironwork."² Uncompleted.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 2.—Locks operating machinery—Continued.

	Amount.		
	Gatun.	Pedro Miguel.	Miraflores.
High tension switch chambers:			
Number of chambers.....	2	2	2
Original cost of equipment.....	\$2,682.78	\$2,682.78	\$2,682.77
Installation.....	1,344.63	878.25	2,126.95
Total cost of equipment.....	4,027.41	3,561.03	4,809.72
Average cost per room.....	2,013.70	1,780.51	2,404.86
Power cable: ¹			
Original cost cable and equipment.....	\$313,492.21	\$107,568.18	\$195,919.26
Installation.....	72,660.23	47,005.85	92,503.03
Total cost.....	386,152.44	154,574.03	288,422.29
Doors for cable manholes and crossovers:			
Original cost of equipment.....	230.30	57.24	126.13
Installation.....	324.61	257.57	447.35
Total cost.....	554.91	314.81	573.48
Lighting and telephone system:			
Original cost of equipment.....	65,223.28	34,204.54	55,697.65
Installation.....	40,952.55	28,850.70	32,877.71
Total cost.....	105,275.83	63,055.24	88,575.36
Machinery chambers and operating tunnels, finishing.....	20,831.47	13,935.53	20,892.73
Screens:			
Number of screens.....	6	6	6
Original cost of equipment.....	\$4,678.40	\$4,821.96	\$3,706.62
Assembling.....	1,054.48	3,013.06	657.55
Total cost of screens.....	5,732.88	7,835.02	4,364.17
Average cost per screen.....	955.48	1,305.84	727.36
Decking machinery chambers and approach walls:			
Original cost of equipment.....	60,001.87	71,723.32	29,181.31
Installation.....	32,316.11	33,969.07	29,514.25
Total cost decking machinery chambers and approach walls.....	92,317.98	105,692.39	58,695.56
Towing track system:			
Linear feet of track.....	37,326	24,010	31,153
Original cost of equipment.....	307,443.20	201,581.26	258,149.47
Installation, mechanical and electrical.....	141,798.17	124,274.49	148,797.47
Total towing track system.....	449,241.37	325,855.75	406,946.94
Average cost per linear foot.....	12.04	13.57	13.06
Caisson sills, adjusting.....	13,830.14	6,966.00	9,053.09
Float wells:			
Number of wells.....	20	12	14
Original cost of machinery.....	\$8,675.14	\$5,182.96	\$6,084.82
Installation, mechanical and electrical.....	2,092.74	1,621.08	1,555.51
Total cost float wells.....	10,767.88	6,804.04	7,640.33
Average cost per well.....	538.40	567.00	545.74
Footbridges and lift wall ladders, installation.....	480.01	248.85	652.21
Machinery and cable pit pumps:			
Number of pumps.....	3	2	2

¹ Original cost of cable not as yet distributed between different locks and duct lines.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 2.—Locks operating machinery—Continued.

	Amount.		
	Gatun.	Pedro Miguel.	Miraflores.
Machinery and cable pit pumps—Continued.			
Original cost of machinery.....	\$1,168.20	\$804.28	\$804.28
Installation, mechanical and electrical.....	69.24	188.23	123.81
Total cost machinery and cable pit pumps.....	1,237.44	992.51	928.09
Average cost per pump.....	412.48	496.26	464.05
Control-house equipment:			
Original cost of equipment.....	27,617.13	20,059.42	26,016.78
Machinery installation.....	11,795.96	7,855.79	14,734.42
Total cost control-house equipment.....	39,413.09	27,915.21	40,751.20
Doors and grill, operating tunnel:			
Number of doors.....	44	24	31
Original cost of equipment.....	\$1,990.50	\$1,096.66	\$1,407.58
Installation.....	2,423.96	1,433.70	2,310.60
Total cost of doors and grill, operating tunnel.....	4,414.46	2,530.36	3,718.18
Average cost per door.....	100.33	105.43	119.94
Concrete used in machinery installation:			
Number of cubic yards.....	26,491.1	21,150.79	28,055.25
Total cost concrete.....	\$328,782.69	\$245,799.10	\$318,283.15
Average cost per cubic yard.....	12.4111	11.6213	11.3449
Total operation machinery installed.....	3,485,045.63	2,157,795.78	2,791,483.87
Administrative and general expense.....	198,244.74	132,108.12	172,535.09
Grand total operating machinery.....	3,683,290.37	2,289,903.90	2,964,018.96

TABLE 3.—Transmission system.

	Amount.
Surveys and testing.....	\$16,690.80
Inspection.....	18,191.36
Towers:	
Number of towers.....	815.00
Tower erection.....	747,982.23
Average cost per tower.....	917.77
Insulators and wires:	
Number of miles.....	44.46
Hanging insulators and stringing wires.....	266,401.06
Average cost per mile.....	5,991.93
Duct lines:	
Gatun—	
Linear feet of line.....	14,239.00
Construction of duct ¹	78,688.08
Average cost per foot.....	5.53
Pedro Miguel—	
Linear feet of line.....	11,012.00
Construction of duct ¹	92,441.13
Average cost per foot.....	8.39
Miraflores—	
Linear feet of line.....	2,650.00
Construction of duct ¹	15,564.69
Average cost per foot.....	5.87

¹Cost of cable not as yet segregated from locks account.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 3.—*Transmission system*—Continued.

	Amount.
Transformer substations:	
Cristobal—	
Building.....	\$114,810.30
Original cost of equipment.....	4,426.62
Installation of equipment.....	4,131.34
Total cost of Cristobal substation.....	123,368.26
Gatun—	
Building.....	145,717.92
Original cost of equipment.....	26,812.89
Installation of equipment.....	14,005.22
Total cost Gatun substation.....	186,536.03
Miraflores—	
Building.....	103,509.04
Original cost of equipment.....	43,038.59
Installation of equipment.....	8,984.57
Total cost Miraflores substation.....	155,532.20
Balboa—	
Building.....	45,565.12
Original cost of equipment.....	2,807.71
Installation of equipment.....	801.01
Total cost Balboa substation.....	49,173.84
Total division cost transmission system.....	1,750,569.68
Administrative and general expense.....	144,786.97
Total cost transmission system.....	1,895,356.65

TABLE 4.—*Aids to navigation.*

Item.	Amount.
Preliminary work.....	\$49,124.26
Preparation sailing chart.....	1,018.67
West breakwater light.....	27,369.34
West breakwater beacon.....	272.77
Beacon No. 1, Atlantic.....	1,507.06
Beacon No. 2, Atlantic.....	430.92
Beacon No. 3, Atlantic.....	547.54
Beacon No. 4, Atlantic.....	1,961.71
Tower No. 5, Atlantic.....	5,122.06
Tower No. 6, Atlantic.....	3,037.50
Tower No. 1, lake.....	5,903.82
Tower No. 2, lake.....	12,217.37
Tower No. 3, lake.....	3,269.51
Tower No. 4, lake.....	2,636.30
Tower No. 5, lake.....	7,166.60
Tower No. 6, lake.....	3,470.68
Tower No. 7, lake.....	2,668.15
Tower No. 8, lake.....	3,996.10
Tower No. 9, lake.....	2,680.80
Tower No. 10, lake.....	3,174.09
Tower No. 11, lake.....	4,973.30
Tower No. 12, lake.....	3,822.91
Tower No. 13, lake.....	2,893.57
Tower No. 14, lake.....	3,739.44
Tower No. 15, lake.....	4,229.34
Tower No. 16, lake.....	4,038.17
Tower No. 17, lake.....	5,414.89
Tower No. 18, lake.....	3,763.01
Beacon No. 19, lake.....	23.96
Beacon No. 20, lake.....	23.96
Tower No. 22, lake.....	2,511.10
Tower No. 23, lake.....	6,209.01
Tower No. 24, lake.....	1,991.52
Tower No. 25, lake.....	3,674.71
Tower No. 27, lake.....	3,711.38
Tower No. 28, lake.....	2,647.69
Beacon, Santa Cruz.....	1,200.36

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 4.—Aids to navigation—Continued.

Item.	Amount.
Beacon, Bohío, south.....	\$2, 157. 42
Beacon, Tabernilla.....	1, 014. 99
Beacon, Bas Obispo, north.....	513. 21
Beacon, Bas Obispo, south.....	162. 02
Beacons, Culebra Cut.....	10, 721. 28
Beacon No. 32, Culebra Cut.....	1, 057. 43
Tower No. 1, Pacific.....	7, 323. 84
Tower No. 2, Pacific.....	4, 691. 83
Tower No. 3, Pacific.....	7, 920. 48
Tower No. 4, Pacific.....	7, 003. 52
Beacon No. 5, Pacific.....	2, 581. 90
Beacon No. 6, Pacific.....	775. 72
Beacon No. 7, Pacific.....	2, 028. 28
Beacon No. 8, Pacific.....	1, 933. 42
Beacon No. 9, Pacific.....	771. 29
Beacon No. 10, Pacific.....	332. 27
Beacon No. 11, Pacific.....	134. 24
Tower No. 12, Pacific.....	2, 285. 77
Tower No. 13, Pacific.....	2, 036. 65
Reference targets.....	8, 532. 16
Reference points.....	141. 15
Transmission lines:	
Atlantic entrance, west.....	\$3, 537. 36
Atlantic entrance, east.....	4, 426. 16
To Tower No. 25, lake.....	101. 30
To Tower No. 28, lake.....	1, 147. 37
Bas Obispo conduit.....	8, 236. 97
Bas Obispo to Pedro Miguel.....	22, 196. 86
Pacific entrance, east.....	4, 436. 44
Pacific entrance, west.....	1, 620. 33
Total transmission lines.....	47, 702. 99
Gas buoys, lake section.....	4, 479. 44
Gas buoys, Pacific entrance.....	19, 248. 11
Gas buoys, general.....	156, 942. 22
Gas buoys, 22' shoal, Limon Bay.....	772. 43
Spar buoys, unlocated.....	8, 021. 90
Miscellaneous.....	6, 649. 39
Buoy sinkers.....	2, 155. 81
Beacons, common.....	6, 439. 07
Lenses for Pacific beacons.....	60. 09
Permanent tool chests.....	11. 75
Beacon lanterns, spares.....	843. 63
Flashing apparatus, all towers.....	77. 51
Flashing apparatus, spares.....	75. 80
Illuminating apparatus, towers 3-23.....	6, 264. 79
Carpentry work, all towers.....	3. 35
Temporary lights, Pacific entrance.....	658. 29
Total division cost.....	514, 878. 81
Administrative and general expense.....	43, 716. 43
Total cost.....	558, 595. 24

TABLE 5.—Cristobal terminals.

	Quantities.	Amount.	Unit cost.
COALING PLANT.			
Miscellaneous:	<i>Cubic yards.</i>		
Designing.....		\$6, 625. 93	.....
Surveys.....		2, 700. 02	.....
Boring and test pits.....		147. 76	.....
Inspection in the United States.....		5, 953. 32	.....
Temporary tracks.....		17, 098. 15	.....
Division expense.....		1, 125. 38	.....
Total division cost.....		33, 650. 56	.....
Administrative and general expense.....		1, 682. 14	.....
Total cost.....		35, 332. 70	.....
Dredging:			
Clearing.....	395, 034	474. 28	\$0.0012
Surveys.....	395, 034	1, 725. 01	.0044
Operation dipper dredges.....	73, 623	4, 351. 72	.0591
Maintenance dipper dredges.....	73, 623	4, 458. 48	.0606
Operation tugs and clapets.....	73, 623	3, 533. 87	.0480

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 5.—Cristobal terminals—Continued.

	Quantities.	Amount.	Unit cost.
COALING PLANT—continued.			
Dredging—Continued.	<i>Cubic yards.</i>		
Maintenance tugs and claps.	73,623	\$2,000.27	\$0.0273
Operation pipe-line dredges	321,411	45,594.77	.1419
Maintenance pipe-line dredges	321,411	48,351.77	.1504
Pipe lines	321,411	16,406.47	.0510
Dikes	321,411	7,631.26	.0237
Drilling	395,034	53,805.09	.1362
Blasting	395,034	46,705.34	.1182
Operation miscellaneous floating equipment	395,034	688.74	.0017
Maintenance floating equipment	395,034	1,323.89	.0034
Plant, arbitrary	237,640	11,454.25	.0482
Division expense	395,034	10,203.50	.0258
Total division cost	395,034	258,727.71	.6550
Administrative and general expense		29,747.18	.0753
Total cost	395,034	288,474.89	.7303
Foundations, retaining wall construction:			
Surveys		675.62	
Piling in place	linear feet 82,105	31,534.34	.3841
Excavation for foundations	3,781	4,635.69	1.2260
Concrete	3,123	13,344.81	4.2731
Reinforcements in place		497.60	
Fixed irons in place		623.67	
Forms for retaining wall		3,329.93	
Maintenance of equipment		3,035.84	
Division expense		1,920.95	
Total division cost		59,598.35	
Administrative and general expense		2,791.33	
Total cost		62,389.68	
Foundations, caisson construction:			
Surveys		675.63	
Cylinders in place		10,645.97	
Excavation in cylinders	105	820.76	7.8168
Reinforcements for cylinders		69.76	
Trestles		21,971.28	
Maintenance of equipment		2,069.28	
Division expense		1,236.94	
Total division cost		37,489.62	
Administrative and general expense		1,215.02	
Total cost		38,704.64	
Backfilling:			
Transportation		451.21	
Filling and grading		750.70	
Maintenance of equipment		52.93	
Division expense		68.23	
Total division cost		1,323.07	
Administrative and general expense		14.08	
Total cost		1,337.15	
Total cost coaling plant		426,239.06	
Fuel-oil tanks:			
Land damages		2,415.00	
Surveys		298.68	
Roadways		3,765.70	
Tank foundations		4,505.85	
Concrete gutters		1,103.37	
Pipe lines		1,454.19	
Painting		2,599.08	
Contract payments		31,330.13	
Local inspection		2,120.15	
Division expense		102.00	
Total fuel-oil tanks		49,694.15	
Total Cristobal terminals		475,933.21	

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa.

	Quantities.	Amount.	Unit cost.
Preliminary and general work:	<i>Cubic yards.</i>		
Surveys.....		\$27,410.98	
Clearing site.....		7,835.89	
Boring and test pits.....		2,294.02	
Division expense.....		2,195.41	
Total division cost.....		35,148.26	
PREPARING SITES, GENERAL.			
Miscellaneous work:			
Removal of buildings.....		67,579.19	
Removal of landing stage for Union Oil Co.....		10,627.07	
Removal and rearrangement of Panama R. R. tracks.....		98,963.93	
General tracks.....		73,787.98	
Removal and reconstruction Balboa-Ancon road.....		6,246.67	
Removal and construction of water mains.....		13,783.48	
Concrete drain ditch, Sosa Hill.....	368	5,003.12	\$13.5954
Removal of quartermaster's material yard.....		5,609.56	
Line to Diablo Hill.....	114,391	68,397.46	.6067
Panama R. R. dock.....		10,385.99	
Drainage around Balboa wye and yards.....		699.36	
Temporary installation Empire shops, etc.....		61,628.43	
Construction new dredge landing.....		1,304.02	
Division expense.....		11,430.71	
Total division cost.....		435,446.97	
Curundu River drainage culvert:			
Preliminary and general work—			
Surveys.....		288.06	
Designing.....		24.00	
Total.....		312.06	
Foundations—			
Clearing.....		153.16	
Excavation by hand.....	2,471	3,786.11	1.5322
Wooden piles, linear feet.....	18,412	16,883.55	.9170
Backfilling.....		111.59	
Pumps.....		328.88	
Total.....		21,263.29	
Concrete—			
Concrete.....	1,664	12,121.64	7.2846
Reinforcements.....		4,460.93	
Pumps.....		909.36	
Tracks.....		29.71	
Tidal gate.....		144.53	
Total.....		17,666.17	
Division expense.....		1,895.45	
Total division cost.....		41,137.01	
Excavation:			
Clearing.....	418,562	662.84	.0015
Drilling.....	418,562	31,740.45	.0758
Blasting.....	418,562	36,645.55	.0876
Excavation by power.....	418,562	31,337.24	.0749
Excavation by hand.....	418,562	4,188.30	.0100
Tracks.....	418,562	32,112.21	.0764
Transportation.....	418,562	15,662.61	.0377
Dumps.....	418,562	15,848.55	.0379
Pumps.....	418,562	2,711.66	.0065
Maintenance of equipment.....	418,562	24,585.95	.0587
Plant arbitrary.....	418,562	40,178.32	.0960
Division expense.....	418,562	9,783.33	.0234
Total division cost.....	418,562	245,457.01	.5864
Filling:			
Tracks.....	764,042	111,356.22	.1458
Trestles.....	764,042	2,460.14	.0032
Transportation.....	764,042	38,389.75	.0502
Filling and grading.....	764,042	73,541.39	.0963
Maintenance of equipment.....	764,042	18,550.63	.0243
Plant arbitrary.....	764,042	58,554.16	.0766
Division expense.....	764,042	9,755.19	.0128
Total division cost.....	764,042	312,607.48	.4092

NOTE.—Bold-face type indicates credit.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa—Continued.

	Quantities.	Amount.	Unit cost.
PREPARING SITES, GENERAL—continued.			
Yards and tracks:	<i>Cubic yards.</i>		
Filling.....	54,210	\$27,942.55	\$0.5155
Installation.....		10,019.47	
Division expense.....		1,014.56	
Total division cost.....		38,976.58	
Total preliminary work and preparing site.....		1,108,773.31	
Administrative and general expense.....		85,385.55	
Total.....		1,194,158.86	
Dredging inner harbor:			
Clearing.....	3,698,781	5,675.56	.0015
Operation seagoing suction dredges.....	93,882	4,064.63	.0433
Repairs seagoing suction dredges.....	93,882	1,332.77	.0142
Operation small-ladder dredge.....	666,789	25,633.98	.0534
Repairs small-ladder dredges.....	666,789	15,673.68	.0235
Operation 3-yard ladder dredges.....	10,000	1,166.71	.1167
Repairs 3-yard ladder dredges.....	10,000	853.11	.0853
Operation small-dipper dredges.....	15,699	2,179.79	.1388
Repairs small-dipper dredges.....	15,699	1,072.43	.0683
Operation pipe-line dredges.....	2,912,411	116,604.20	.0400
Repairs pipe-line dredges.....	2,912,411	67,847.33	.0233
Dikes.....	2,912,411	700.54	.0002
Pipe lines.....	2,912,411	22,307.15	.0077
Ditching.....	2,912,411	1,974.95	.0005
Operation tugs, clapets, and scows.....	692,488	47,352.43	.0684
Repairs tugs, clapets, and scows.....	692,488	18,845.50	.0027
Operation miscellaneous equipment.....	3,698,781	15,735.84	.0043
Repairs miscellaneous equipment.....	3,698,781	15,179.95	.0041
Plant arbitrary.....	3,698,781	57,190.27	.0155
Division expense.....	3,698,781	13,783.01	.0037
Total division cost.....	3,698,781	435,173.83	.1177
Administrative and general expense.....	3,698,781	41,630.50	.0113
Total cost.....	3,698,781	476,804.33	.1290
Reclaiming land:			
Clearing.....	2,912,411	425.13	.0002
Pipe lines.....	2,912,411	16,104.58	.0055
Dikes.....	2,912,411	66,278.97	.0228
Operation relay pumps.....	2,912,411	60,877.16	.0209
Repairs relay pumps.....	2,912,411	7,739.60	.0027
Plant arbitrary.....	2,912,411	1,391.09	.0005
Division expense.....	2,912,411	4,981.30	.0016
Total division cost.....	2,912,411	157,797.83	.0542
Administrative and general expense.....	2,912,411	14,042.63	.0048
Total cost.....	2,912,411	171,840.46	.0590
Total dredging cost.....	3,698,781	648,644.79	.1754
Entrance basin:			
Dry excavation.....	388,118	386,004.07	.9946
Administrative and general expense.....		28,943.67	
Total entrance basin.....		414,947.74	
MAIN DRY DOCK.			
Preliminary work:			
Designing.....		14,094.71	
Surveys.....		5,743.04	
Boring and test pits.....		10,652.94	
Inspection in United States.....		4,327.31	
Inspection on the Isthmus.....		162.50	
Granite from Cocoli Island.....		12.85	
Testing material.....		134.16	
Division expense.....		1,440.04	
Total division cost.....		36,567.55	
Dry excavation:			
Clearing.....	855,093	13,621.13	.0159
Drilling.....	855,093	134,277.47	.1571
Blasting.....	855,093	89,741.99	.1049
Excavation by power.....	855,093	76,097.26	.0890
Excavation by hand.....	855,093	1,042.83	.0012

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa—Continued.

	Quantities.	Amount.	Unit cost.
MAIN DRY DOCK—continued.			
Dry excavation—Continued.	<i>Cubic yards.</i>		
Tracks.....	855,093	\$120,220.52	\$0.1406
Transportation.....	855,093	108,182.41	.1265
Dumps.....	855,093	11,031.72	.0129
Pumps.....	855,093	39,671.97	.0464
Maintenance of equipment.....	855,093	98,742.28	.1155
Plant arbitrary.....	855,093	130,471.86	.1526
Division expense.....	855,093	27,334.22	.0320
Total division cost.....	855,093	850,435.66	.9946
Less excavation chargeable to entrance basin.....	388,118	386,004.07	.9946
Total.....	466,975	464,431.59	.9946
Gates:			
Recess covers.....		2,277.07	
Miter gate-moving machines.....		1,039.18	
Division expense.....		5.20	
Total division cost.....		3,321.45	
Total main dry dock.....		504,320.59	
Administrative and general expenses.....		37,680.70	
Total.....		542,001.29	
DRY DOCK NO. 2.			
Miscellaneous:			
Designing.....		1,162.53	
Surveys.....		132.84	
Inspection in United States.....		386.14	
Division expense.....		20.24	
Total division cost.....		1,701.75	
Dry excavation:			
Clearing.....	93,677	8.04	.0001
Drilling.....	93,677	6,452.95	.0689
Blasting.....	93,677	3,892.90	.0416
Excavation by power.....	93,677	8,002.86	.0854
Excavation by hand.....	93,677	97.35	.0010
Tracks.....	93,677	5,631.31	.0602
Transportation.....	93,677	16,732.20	.1786
Dumps.....	93,677	854.92	.0091
Pumps.....	93,677	3,397.95	.0362
Maintenance of equipment.....	93,677	11,862.04	.1266
Plant arbitrary.....	93,677	16,561.60	.1768
Division expense.....	93,677	2,657.72	.0284
Total division expense.....	93,677	76,151.84	.8129
Preparing foundations:			
Wooden piles.....		1.84	
Concrete piling.....		31.59	
Calissons.....		.35	
Concrete footings.....		423.01	
Division expense.....		1.64	
Total division cost.....		458.43	
Total Dry Dock No. 2.....		78,312.02	
Administrative and general expenses.....		9,508.09	
Total Dry Dock No. 2.....		87,820.11	
COALING PLANT.			
Miscellaneous:			
Designing.....		5,746.67	
Surveys.....		1,997.30	
Boring and test pits.....		1,596.97	
Clearing.....		82.25	
Inspection in United States.....		2,462.53	
Berm cranes.....		40,000.00	
Division expense.....		1,728.84	
Total division cost.....		53,614.56	
Dry excavation:			
Clearing.....	224,325	5,224.79	.0233
Drilling.....	224,325	31,427.23	.1401

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa—Continued.

	Quantities.	Amount.	Unit cost.
COALING PLANT—continued.			
Dry excavation—Continued.	<i>Cubic yards.</i>		
Blasting.....	224,325	\$12,246.50	\$0.0546
Excavation by power.....	224,325	19,133.18	.0853
Excavation by hand.....	224,325	2,794.93	.0125
Tracks.....	224,325	19,119.84	.0852
Transportation.....	224,325	21,591.91	.0963
Dumps.....	224,325	1,495.72	.0067
Pumps.....	224,325	7,656.06	.0341
Maintenance of equipment.....	224,325	22,923.87	.1022
Plant arbitrary.....	224,325	33,301.76	.1483
Division expense.....	224,325	4,954.36	.0221
Total division cost.....	224,325	181,870.15	.8107
Preparing foundations:			
Excavation.....	964	2,653.91	2.7530
Pumps.....		13.35	.0138
Construction tracks.....		1,391.58	1.4435
Maintenance of equipment.....		9.47	.0100
Division expense.....		552.02	.5726
Total division cost.....		4,620.33	4.7929
Concrete masonry:			
Cement.....	2,138	2,457.27	1.1493
Stone.....	2,138	2,463.25	1.1521
Sand.....	2,138	1,184.34	.5539
Mixing.....	2,138	1,618.33	.7569
Forms.....	2,138	2,358.80	1.1033
Placing.....	2,138	4,007.86	1.8746
Reinforcements in place.....	2,138	421.17	.1970
Pumps.....	2,138	31.60	.0148
Maintenance of equipment.....	2,138	8.03	.0038
Plant arbitrary.....	2,138	252.00	.1179
Division expense.....	2,138	1,191.96	.5575
Total division cost.....	2,138	15,994.61	7.4811
Backfilling:			
Filling and grading.....	1,816	2,146.47	1.1820
Plant arbitrary.....	1,816	108.96	.0600
Division expense.....	1,816	285.95	.1574
Total division cost.....	1,816	2,541.38	1.3994
Foundations for berm cranes:			
Excavation.....	276	2,728.49	9.8858
Concrete.....	2,620	19,509.68	7.4464
Reinforcements.....linear feet..	73,272	1,181.63	.0161
Drilling.....		65.97	
Blasting.....		249.75	
Fixed iron.....		25.09	
Tracks, permanent.....		2,222.16	
Back filling.....		23.97	
Plant arbitrary.....		443.76	
Division expense.....		1,482.54	
Total division cost.....		27,933.04	
Erection berm cranes:			
Steel erection.....		628.10	
Division expense.....		67.00	
Total division cost.....		695.10	
Total coaling plant.....		287,269.17	
Administrative and general expenses.....		15,865.63	
Total coaling plant.....		303,134.80	
SEA WALL.			
Preliminary work:			
Surveys.....		68.71	
Designing.....		50.00	
Division expense.....		8.14	
Total division expense.....		126.85	
Administrative and general expense.....		5.76	
Total cost.....		132.61	

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa—Continued.

	Quantities.	Amount.	Unit cost.
PERMANENT SHOPS.			
	<i>Cubic yards.</i>		
Miscellaneous, general.....		\$254,401.77	
Steel erection.....		34,508.77	
Machine and erection shop.....		499,625.88	
Forge shop.....		136,553.91	
Steel storage shed.....		74,196.37	
Boiler and shipfitters' shop.....		161,029.34	
General storehouse.....		247,296.56	
Paint shop.....		44,747.11	
Car shop.....		55,303.00	
Planing mill.....		118,812.04	
Galvanizing building.....		41,777.82	
Lumber and equipment shed.....		64,944.00	
Pattern storage room.....		55,843.35	
Foundry.....		207,699.69	
Coke shed.....		9,149.71	
Boilerhouse.....		19,991.19	
Roundhouse.....		142,206.98	
Gas house.....		9,048.40	
Toilets.....		48,533.32	
Paint house.....		4,724.61	
Main office.....		59,494.90	
Sand house.....		11,809.57	
Shop tunnel.....		142,763.94	
Total division cost.....		2,444,462.23	
Administrative and general expense.....		190,907.37	
Total cost.....		2,635,369.40	
DOCKS.			
Preliminary work:			
Designing.....		1,175.33	
Surveys and borings.....		10,044.02	
Clearing.....		2,118.74	
Dikes.....		9,835.23	
Construction tracks.....		16,651.76	
Division expense.....		1,879.18	
Total division cost.....		41,704.31	
Administrative and general expense.....		4,745.21	
Total preliminary work.....		46,449.52	
Quay wall, north of concrete dock:			
Preliminary work.....		464.01	
Excavation for and in piers.....	19,896	44,918.02	\$2.2576
Caisson shells.....	6,464.5	84,260.37	13.0343
Filling caissons with concrete.....	7,945	52,973.61	6.6675
Excavation for floor girders.....	3,832	8,633.58	2.2520
Concrete floor.....	7,359	178,294.24	24.2281
Back filling.....		771.68	
Miscellaneous.....		27,268.65	
Steel cylinders, 6-foot.....		5.37	
Paving.....square feet.....	75,683	23,611.04	.3120
Total division cost.....		421,200.57	
Administrative and general expenses.....		43,725.30	
Total.....		464,925.87	
Quay wall, south of concrete dock:			
Preliminary work.....		27,592.99	
Dredging.....	25,720	12,059.60	.4689
Excavation for and in piers.....	669	1,533.94	2.2929
Caisson shells.....		3,600.38	
Filling caissons with concrete.....	1,487	13,870.33	9.3277
Concrete floor.....		1,065.42	
Superstructure.....		28.57	
Miscellaneous.....		4,200.19	
Steel cylinders, 6-foot.....		43,929.56	
Paving.....		75.87	
Total division cost.....		107,956.85	
Administrative and general expenses.....		10,293.30	
Total.....		118,250.15	

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 6.—Terminal facilities—Balboa—Continued.

	Quantities.	Amount.	Unit cost.
DOCKS—continued.			
Bulkhead quay wall, between wharf and Pier No. 1:	<i>Cubic yards.</i>		
Preliminary work.....		\$1,980.56	.....
Excavation for and in piers.....	7,835	19,283.37	\$2.4612
Caisson shells.....	1,657	28,741.91	17.3458
Filling caissons with concrete.....	3,563	21,255.85	5.9657
Excavation for floor girders.....	52	1,629.09	31.3286
Concrete floor.....	2,462	40,357.22	16.3920
Concrete balustrade.....	21	708.60	33.7429
Superstructure.....		30.23	.....
Back filling.....	2,313	4,951.16	2.1406
Miscellaneous.....		10,639.36	.....
Paving.....		728.79	.....
Total division cost.....		130,306.14	.....
Administrative and general expenses.....		17,077.05	.....
Total.....		147,383.19	.....
Pier No. 1:			
Preliminary work.....		6,452.60	.....
Excavation for and in piers.....	31,666	93,398.16	2.9495
Caisson shells.....	10,773.5	135,500.88	12.5772
Filling caissons with concrete.....	13,346	89,604.07	6.7139
Excavation for floor girders.....	7,373	11,000.11	1.4920
Concrete floor.....	10,222	165,487.16	16.1893
Superstructure.....		153.25	.....
Back filling.....	939	1,811.09	1.9287
Miscellaneous.....		8,220.25	.....
Steel cylinders.....		18.43	.....
Paving.....		103.14	.....
Total division cost.....		511,749.14	.....
Administrative and general expenses.....		48,964.19	.....
Total.....		560,713.33	.....
Total cost, all docks:			
Division cost.....		1,212,917.01	.....
Administrative and general expenses.....		124,805.05	.....
Total.....		1,337,722.06	.....
FUEL-OIL-HANDLING PLANT.			
Permanent oil tanks and pipe lines:			
Surveys.....		154.54	.....
Tracks.....		53.15	.....
Concrete foundations.....		2,422.71	.....
Tanks.....		873.54	.....
Pipe lines.....		796.74	.....
Maintenance of equipment.....		15.21	.....
Contract payments.....		31,325.00	.....
Painting.....		910.39	.....
Inspection on the Isthmus.....		43.05	.....
Concrete gutters.....		2,201.36	.....
Fire walls.....		5,508.20	.....
Division expense.....		8.49	.....
Total division cost.....		44,312.38	.....
Administrative and general expenses.....		348.63	.....
Total cost.....		44,661.01	.....
Dredging berth for ships:			
Dredging.....	60,776	5,976.95	.0983
Administrative and general expenses.....	60,776	92.14	.0015
Total cost.....	60,776	6,069.09	.0998
Total fuel-oil-handling plant.....		50,730.10	.....
Division cost Balboa terminal facilities.....		6,665,466.24	.....
Administrative and general expenses.....		549,215.72	.....
Total.....		7,214,681.96	.....

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 7.—*Permanent town sites.*

Item.	La Boca.	Balboa.	Pedro Miguel.
Preliminary and general work.....	\$36,382.91	\$97,976.11	\$32,316.78
Preliminary maintenance.....		721.93	
Road construction.....	28,577.45	86,911.75	20,712.77
Drainage.....	14,354.13	1,948.41	22,200.84
Waterworks.....	19,296.68	32,057.98	19,519.88
Sewer system.....	25,339.20	136,908.49	11,534.80
Walks.....	4,771.19	463.03	281.62
Balboa nursery.....		777.20	
Lot improvement.....		12,407.29	
Street lighting.....			213.34
Underground duct system.....		22,966.60	3,267.45
Division expense.....	3,817.67	15,977.56	2,301.77
Total division cost.....	132,539.23	409,116.35	112,349.25
Administrative and general expense.....	10,366.18	34,720.09	14,868.13
Total cost.....	142,905.41	443,836.44	127,217.38

TABLE 8.—*Permanent buildings.*

	Amount.
Designing, general.....	\$14,771.16
Administration building:	
Preliminary work.....	19,120.48
Preparing site.....	27,967.34
Grading and filling.....	5,368.98
Retaining wall.....	716.78
Concrete footings.....	15,360.98
Substructure, concrete walls.....	17,764.26
Concrete in basement floor.....	6,284.90
Steel erection.....	119,755.45
Superstructure.....	83,182.38
Floor and roof arches.....	69,478.58
Interior partitions.....	20,034.56
Rough carpentering.....	18,297.19
Finished carpentering.....	70,594.54
Wire lathing.....	7,827.32
Stucco.....	12,049.00
Plaster.....	75,347.97
Electrical work, rough.....	15,789.67
Electrical work, finished.....	8,869.56
Plumbing, rough.....	16,221.81
Plumbing, finished.....	7,426.79
Marble and stone work.....	5,074.98
Roofing.....	21,092.72
Ornamental ironwork, rough.....	761.10
Ornamental ironwork, finished.....	16.51
Sheet-metal work.....	1,477.76
Painting.....	15,939.89
Miscellaneous construction.....	27,070.71
Division expense.....	28,043.88
Total division cost.....	716,936.09
Administrative and general expense.....	72,972.91
Total administration building.....	789,909.00
Balboa fire station:	
Preliminary work.....	886.87
Grading and filling.....	52.41
Concrete footings.....	170.63
Electrical work, rough.....	14.22
Plumbing, rough.....	316.64
Division expense.....	158.69
Total cost Balboa fire station.....	1,599.36
Balboa schoolhouse:	
Preliminary work.....	543.43
Preparing site.....	1,840.12
Concrete footings.....	173.85
Substructure, concrete walls.....	280.46
Superstructure.....	37.15
Plumbing, rough.....	41.56
Division expense.....	175.55
Administrative and general expense.....	210.35
Total cost Balboa schoolhouse.....	3,302.47

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 8.—*Permanent buildings*—Continued.

	Amount.
20 type B 4-family quarters, Balboa:	
Preliminary work.....	\$1,604.67
Preparing site.....	5,457.80
Grading and filling.....	2,534.53
Retaining wall.....	2,646.55
Concrete footings.....	32,384.68
Substructure, concrete walls.....	51,162.91
Superstructure.....	44,013.64
Floor and roof arches.....	57,528.35
Interior partitions.....	21,088.84
Rough carpentry.....	23,923.52
Finished carpentry.....	33,992.83
Wire lath and plaster.....	1,188.02
Stucco.....	6,629.74
Plaster.....	6,684.14
Electrical work, rough.....	6,052.11
Electrical work, finished.....	3,339.49
Plumbing, rough.....	21,327.53
Plumbing, finished.....	4,095.35
Roofing.....	23,566.23
Ornamental ironwork, rough.....	20.00
Sheet-metal work.....	1,766.43
Painting.....	7,231.88
Miscellaneous construction.....	6,859.14
Division expense.....	21,110.68
Total division cost.....	386,209.06
Administrative and general expense.....	41,905.58
Total 20 type B 4-family quarters.....	428,114.64
8 type B 4-family quarters, Balboa:	
Preliminary work.....	184.56
Preparing site.....	49.13
Grading and filling.....	209.06
Retaining wall.....	62.34
Concrete footings.....	4,300.28
Substructure, concrete walls.....	8,765.95
Superstructure.....	8,818.84
Floor and roof arches.....	7,114.28
Interior partitions.....	1,568.61
Rough carpentry.....	2,302.26
Finished carpentry.....	229.33
Wire lath and plaster.....	704.58
Plaster.....	263.06
Electrical work, rough.....	212.77
Electrical work, finished.....	47.33
Plumbing, rough.....	597.34
Plumbing, finished.....	396.15
Roofing.....	29.70
Sheet-metal work.....	8.03
Painting.....	254.11
Miscellaneous construction.....	781.86
Division expense.....	2,101.54
Total division cost.....	39,001.11
Administrative and general expense.....	3,466.57
Total 8 type B 4-family quarters, Balboa.....	42,467.68
Total 28 type B 4-family quarters, Balboa.....	470,582.32
9 type A 2-family quarters, Balboa:	
Preliminary work.....	707.86
Preparing site.....	72.30
Grading and filling.....	542.84
Concrete footings.....	2,307.38
Substructure, concrete walls.....	7,516.15
Superstructure.....	3,961.55
Floor and roof arches.....	2,129.18
Interior partitions.....	430.31
Rough carpentry.....	629.11
Finished carpentry.....	47.56
Wire lath and plaster.....	737.65
Plaster.....	45.79
Electrical work, rough.....	19.26
Plumbing, rough.....	136.48
Plumbing, finished.....	11.67
Roofing.....	11.44

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 8.—*Permanent buildings*—Continued.

	Amount.
9 type A 2-family quarters, Balboa—Continued.	
Miscellaneous construction.....	\$476.30
Division expense.....	954.93
Total division cost.....	20,737.76
Administrative and general expense.....	955.75
Total 9 type A 2-family quarters.....	21,693.51
Reerected buildings:	
45 gold married quarters, Ancon.....	77,783.34
52 silver married quarters, La Boca.....	110,045.50
1 gold bachelor quarters, Balboa.....	1,644.09
1 gold married quarters, Pedro Miguel.....	7.76
24 silver bachelor quarters, La Boca.....	30,380.51
32 bath and wash houses and cook sheds, La Boca.....	9,331.53
15 range closets, La Boca.....	6,177.63
1 recreation hall, La Boca.....	1,098.19
1 mess hall, La Boca.....	196.93
1 clubhouse, Pedro Miguel.....	19,695.77
1 colored school, Paraiso.....	945.56
1 range closet, Paraiso.....	502.17
2 hospital wards, Ancon, moved and reerected.....	2,535.42
Total.....	260,344.40
Total permanent buildings.....	1,562,202.22

TABLE 9.—*Cost of buildings erected by the supply department and charged to other units of construction.*

	Amount.
Gatun hydroelectric plant:	
Preliminary work.....	\$5,663.79
Preparing site.....	59,170.50
Grading and filling.....	1,055.49
Concrete footings.....	31.12
Substructure, concrete walls.....	53,139.27
Steel erection.....	47,690.07
Superstructure.....	62,929.05
Floor and roof arches.....	31,137.60
Interior partitions.....	28.70
Rough carpentry.....	3,146.99
Finished carpentry.....	7,703.22
Wire lath and plaster.....	161.84
Plaster.....	10,107.74
Electrical work, rough.....	160.58
Plumbing, rough.....	3,489.97
Plumbing, finished.....	408.08
Marble and stone work.....	3,408.73
Roofing.....	7,793.00
Ornamental ironwork, rough.....	43.23
Ornamental ironwork, finished.....	194.09
Sheet-metal work.....	31.09
Painting.....	894.39
Miscellaneous construction.....	13,937.07
Division expense.....	9,732.52
Total division cost.....	322,058.18
Administrative and general expense.....	28,142.75
Total Gatun hydroelectric plant.....	350,200.93
Gatehouse Gatun hydroelectric plant:	
Preliminary work.....	32.26
Substructure, concrete walls.....	1,206.58
Steel erection.....	672.89
Superstructure.....	1,377.43
Floor and roof arches.....	698.41
Finished carpentry.....	100.76
Plaster.....	551.13
Electrical work, finished.....	17.51
Roofing.....	998.86
Painting.....	200.97
Miscellaneous construction.....	328.30
Division expense.....	213.80
Total division cost.....	6,398.90

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 9.—Cost of buildings erected by the supply department and charged to other units of construction—Continued.

	Amount.
Gatehouse Gatun hydroelectric plant—Continued.	
Administrative and general expense.....	\$563.19
Total gatehouse Gatun hydroelectric plant	6,962.09
Total Gatun hydroelectric plant and gatehouse	¹ 357,163.02
Balboa shops office building:	
Preliminary work.....	176.87
Preparing site.....	41.97
Grading and filling.....	14.87
Concrete footings.....	125.93
Substructure, concrete walls.....	59.89
Superstructure.....	7,080.31
Floor and roof arches.....	10,715.30
Interior partitions.....	76.35
Rough carpentry.....	2,927.03
Finished carpentry.....	93.27
Stucco.....	52.12
Plaster.....	326.77
Electrical work, rough.....	10.31
Plumbing, rough.....	2,668.69
Roofing.....	27.30
Painting.....	17.13
Miscellaneous.....	114.38
Division expense.....	1,447.68
Total division cost.....	25,976.22
Administrative and general expense.....	93.45
Total Balboa shops office building.....	² 26,069.67
Miraflores transformer substation:	
Preliminary work.....	1,435.23
Preparing site.....	6,664.48
Grading and filling.....	2,437.43
Concrete footings.....	8,669.76
Substructure, concrete walls.....	7,090.22
Steel erection.....	8,864.73
Superstructure.....	16,916.31
Floor and roof arches.....	15,440.83
Interior partitions.....	7,218.57
Rough carpentering.....	2,908.36
Finished carpentering.....	302.27
Wire lathing.....	235.03
Stucco.....	19.95
Plaster.....	4,057.81
Electrical work, rough.....	943.16
Plumbing, rough.....	3,266.63
Plumbing, finished.....	52.06
Marble and stone work.....	1,367.63
Roofing.....	7,829.29
Sheet-metal work.....	73.58
Miscellaneous construction.....	2,080.51
Division expense.....	5,635.20
Total division cost.....	103,509.04
Administrative and general expense.....	10,951.80
Total Miraflores transformer substation	114,460.84
Gatun transformer substation:	
Preliminary work.....	3,033.89
Preparing site.....	2,824.05
Grading and filling.....	645.83
Concrete footings.....	8,897.54
Substructure, concrete walls.....	4,477.67
Steel erection.....	32,786.66
Superstructure.....	17,808.42
Floor and roof arches.....	15,339.36
Interior partitions.....	11,574.64
Rough carpentering.....	3,321.38
Finished carpentering.....	9,044.91
Wire lathing.....	163.12
Stucco.....	1,355.69
Plaster.....	10,489.16
Electrical work, rough.....	386.76

¹ This amount is included in cost of Gatun permanent power plant.² This amount is included in cost of Balboa terminals permanent shops.

EXHIBIT C.—DETAILED COST TO JUNE 30, 1914—Continued.

TABLE 9.—Cost of buildings erected by the supply department and charged to other units of construction—Continued.

	Amount.
Gatun transformer substation—Continued.	
Plumbing, rough.....	\$2,617.54
Plumbing, finished.....	212.51
Marble and stone work.....	2,286.92
Roofing.....	8,895.71
Ornamental ironwork, rough.....	16.33
Ornamental ironwork, finished.....	158.64
Sheet-metal work.....	819.94
Painting.....	199.85
Miscellaneous construction.....	1,218.63
Division expense.....	7,142.77
Total division cost.....	145,717.92
Administrative and general expense.....	13,352.42
Total Gatun transformer substation.....	159,070.34
Cristobal transformer substation:	
Preliminary work.....	1,914.22
Preparing site.....	11,152.35
Grading and filling.....	957.01
Concrete footings.....	8,356.59
Substructure, concrete walls.....	11,057.15
Steel erection.....	31,500.20
Superstructure.....	8,274.80
Floor and roof arches.....	16,661.82
Interior partitions.....	2,414.82
Rough carpentering.....	2,625.46
Finished carpentering.....	243.72
Wire lathing.....	49.53
Stucco.....	69.80
Plaster.....	485.83
Electrical work, rough.....	246.85
Plumbing, rough.....	2,079.17
Plumbing, finished.....	193.89
Marble and stone work.....	1,321.66
Roofing.....	7,244.12
Ornamental ironwork, rough.....	13.06
Ornamental ironwork, finished.....	7.31
Sheet-metal work.....	4.14
Painting.....	57.60
Miscellaneous construction.....	1,121.08
Division expense.....	3,805.83
Total division cost.....	111,858.01
Administrative and general expense.....	8,542.40
Total Cristobal transformer substation.....	120,400.41
Balboa transformer substation:	
Preliminary work.....	1,612.89
Preparing site.....	4,232.06
Grading and filling.....	593.66
Concrete footings.....	3,677.12
Substructure, concrete walls.....	5,285.71
Steel erection.....	4,950.28
Brickwork.....	11.29
Superstructure.....	2,984.96
Floor and roof arches.....	5,674.40
Rough carpentering.....	3,336.03
Finished carpentering.....	1,009.17
Plaster.....	124.88
Electrical work, rough.....	62.42
Plumbing, rough.....	1,987.06
Plumbing, finished.....	54.78
Marble and stone work.....	1,391.49
Roofing.....	6,226.17
Painting.....	.78
Miscellaneous construction.....	346.27
Division expense.....	2,003.72
Total division cost.....	45,565.12
Administrative and general expense.....	1,597.36
Total Balboa transformer substation.....	47,162.48
Total all (4) transformer substations.....	¹ 441,094.07

¹ This amount is included in cost of power transmission system.

EXHIBIT D.—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES
FOR FISCAL YEAR 1913-14.

No.	Item.	Fiscal year.		Increase.	Decrease.
		1914	1913		
1	General administrative expenses.....	\$251,448.60	\$249,471.68	\$1,976.92	.....
	Miscellaneous general expenses:				
2	On Isthmus.....	252,285.70	111,134.25	141,151.45	.....
3	Canal Record.....	23,227.83	21,524.39	1,703.44	.....
4	Clubhouses.....	47,869.18	49,925.96	.....	\$2,056.78
5	Isthmian Canal Commission band.....	.....	8,765.99	.....	8,765.99
6	In the United States.....	100,828.40	90,826.71	10,001.69	.....
	Accounting on Isthmus:				
7	Auditor.....	187,296.27	194,881.64	.....	7,585.37
8	Paymaster.....	62,102.05	75,578.18	.....	13,476.13
9	Collector.....	5,556.90	.....	5,556.90	.....
	Accounting in United States:				
10	Assistant auditor.....	23,704.23	12,914.74	10,789.49	.....
11	Disbursing clerk.....	29,866.91	36,848.56	.....	6,981.65
12	Passenger transportation on Isthmus.....	118,848.00	109,938.72	8,909.28	.....
13	Telegraph and telephones.....	76,182.13	105,299.12	.....	29,116.99
14	Purchasing expenses in the United States..	171,881.61	167,405.86	4,475.75	.....
15	Operation of stores.....	650,489.82	503,358.21	147,131.61	.....
16	Recruiting and repatriating.....	186,451.20	77,777.49	108,673.71	.....
17	Quarters.....	369,722.28	448,603.69	.....	78,881.41
	Construction and engineering department:				
18	Construction of buildings.....	19,096.73	3,887.93	15,208.80	.....
19	Repairs to buildings.....	12,881.69	11,086.69	1,795.00	.....
20	Operation docks and wharves, Panama Canal.....	42,051.67	15,278.55	26,773.12	.....
21	Operation docks and wharves, Panama Railroad Co.....	1,287.74	46,166.51	.....	44,878.77
	Total.....	2,633,078.94	2,340,674.87	292,404.07	.....

APPENDIX I-3.

REPORT OF THE SPECIAL ATTORNEY.

DEPARTMENT OF LAW.

ANCON, CANAL ZONE, *August 4, 1914.*

SIR: I have the honor to submit the following report of the affairs of the department of law for the fiscal year ended June 30, 1914:

The report includes the various activities of the law department of the Isthmian Canal Commission up to April 1, 1914, when the Canal Zone government was reorganized under the Executive order of January 27, 1914, in conformity with section 4 of the Panama Canal act of August 24, 1912, as well as the activities which have been segregated from the department of law since reorganization, as it would be impracticable to deal with these in separate reports.

LEGISLATION.

A number of Executive orders of a legislative character were issued by the President during the last fiscal year, and one important order was issued on June 30, 1913, to become effective on July 4, 1913, which was not mentioned in the last annual report and should be referred to here. The Executive order in question provided for jury trials in all felony cases. Prior to that date jury trials could be had only in capital cases, or cases involving the death penalty or life imprisonment in the penitentiary.

This Executive order has since been superseded by the provisions of the Panama Canal act, which became effective upon the reorganization of the government here, under the Executive order of January 27, 1914, already mentioned. At this time a jury trial is authorized in any criminal case, or civil case at law, originating in the district court on the demand of either party. The effect of the congressional enactment is to broaden very materially the field for jury trials in the Canal Zone. But few demands for a jury trial have been made since the law went into effect. Two jury trials in criminal cases were had; one in the Cristobal branch of the district court and the other in the Balboa branch of the court. Both cases were against American citizens charged with personal violence against British West Indians. The two trials resulted in acquittals. But one demand for a jury has been made in a civil case, and a mistrial resulted.

A report from this office has already been submitted to you on the subject of the jury system in the Canal Zone. It is my opinion that jury trials here should be limited to capital cases. The American community, from which jurors must be selected, is small and is naturally affected by bias or prejudice for or against parties that is likely to be found in any small community. It is my opinion that

an amendment to the law, limiting jury trials to capital cases, would be of benefit to the administration of canal affairs, and more substantial justice would be obtained than can be expected under the present system. If jury trials for cases less than capital are to continue they should be limited to felony cases, and if the case is of a grade less than capital a jury of six men ought to be sufficient.

In the early part of the fiscal year a flying machine was operated across the Isthmus, over the islands on which are situated the canal fortifications. At that time there was no law to prohibit such flights, and in order to prevent them in the future a prohibitive order was issued by the President on August 7, 1913, providing a penalty of \$1,000 fine, or imprisonment not exceeding one year in jail, or both such fine and imprisonment, for a failure to observe it. The newspapers in the United States have announced the prosecution of a publishing company on the west coast for publishing pictures of the fortifications on the islands in the Canal Zone, which pictures were taken at the time the flight of the machine above mentioned was made in the Canal Zone. The Executive order now in force will prevent such pictures from being taken in the future.

On August 29, 1913, an Executive order was issued amending the law relating to bail bonds. Deficiencies in the preexisting law were corrected, and the legislation was made more flexible and adaptable to local conditions.

An Executive order had been issued on May 2, 1911, providing punishment for deported persons who returned to the Canal Zone. This order was construed by the local courts as not being applicable to a temporary return to the Zone. Inasmuch as the Executive order was of a police character, and purposely enacted to exclude undesirables, it was deemed advisable to secure an amendment to the order so as to reach cases of a temporary return, as well as those where the undesirables came back to the Canal Zone to remain permanently. An Executive order was issued on September 25, 1913, which makes it clear that a temporary return is prohibited as well as a permanent one. The Executive order, however, authorizes the chief executive of the Canal Zone, in his discretion, to grant permission to excluded persons to return to the Canal Zone temporarily. The Executive order repeals the order of May 2, 1911.

The preexisting law relating to the carrying of firearms was not found to be satisfactory, and an Executive order was issued on November 7, 1913, repealing the former law and providing for the regulation of the carrying of firearms on a different basis. The new Executive order authorizes permits to be issued for the keeping of firearms at one's residence, place of business, or store, and upon the person of watchmen and others. These permits are issued without charge. Hunting permits are also authorized under the order, of which a license fee of \$1 per annum is charged. Punishment for violations thereof by a fine or imprisonment, or both such fine and imprisonment, is provided.

A number of cases were brought to the attention of the chairman and chief engineer, in which exorbitant rates of interest were charged for the loan of money in the Canal Zone. Some of these cases bore harshly upon the borrowers, and in order to prevent usurious practices in the future an Executive order was issued on November 11, 1913, fixing the legal rate of interest at 6 per cent per

annum, and the conventional rate of 12 per cent per annum. The Executive order authorizes the person paying interest above the rate of 12 per cent per annum to recover back from the usurer all of the interest paid by him.

On January 21, 1914, an Executive order was promulgated by the President to prohibit gifts or gratuities to agents, employees, or servants, without the knowledge and consent of the principal, employer, or master of such agent, employee, or servant, to influence them in their action concerning any business of the principal, employer, or master. The Executive order provides a punishment of a fine or imprisonment, or both such punishments, for any violation thereof. The order was issued as a result of the investigations of the commissary department at Cristobal.

An Executive order by the President was obtained on January 27, 1914, providing punishment of a fine and imprisonment against any person engaging in the practice of hunting deer and other animals at night by the use of lanterns and torches.

The most important order issued by the President during the fiscal year was that of January 27, 1914, to establish a permanent organization for the Canal Zone. This order, by its terms, became effective on the 1st day of April, 1914, at which time the Isthmian Canal Commission was discontinued, and the canal organization then existing was abolished and a new organization established by the Executive order in its stead.

The Executive order created an organization consisting of a department of operation and maintenance, a purchasing department, a supply department, an accounting department, a health department, and an executive secretary. It also authorizes any other departments, offices, or agencies, on the Isthmus or elsewhere, which the Governor of The Panama Canal may deem necessary to establish with the approval of the President. The Panama Canal is placed under the direction of the Governor, subject to the supervision of the Secretary of War.

The department of operation and maintenance is a new feature, and relates to the operation and maintenance of the canal and its auxiliaries.

The supply department is the result of the consolidation of the quartermaster's department with the department of commissary and subsistence, as they existed under the Isthmian Canal Commission.

The accounting department as now organized presents new features, inasmuch as it has taken over not only the department of accounts, as it existed under the Commission, but the collection and disbursement of canal funds as well, and it performs the same duties for the Panama Railroad to an extent consistent with the charter and by-laws of that company.

The purchasing department remains practically the same as under the previous organization, and the same may be said of the health department, except that the latter department now has charge of all matters relating to charities.

The executive secretary has the duties formerly belonging to the head of the department of civil administration, except the collection of taxes, which is now done by the accounting department. The executive secretary has additional duties, such as the control of the

clubs and libraries and the custody of the files and records and supervision of the land office, except that the land office is temporarily retained under the jurisdiction of this office until all land claims pending against the government have been disposed of.

The reorganization required the promulgation of new rules of employment for the permanent force of The Panama Canal, and this was done by the Executive order of February 2, 1914.

The Panama Canal act provides for a district court, as the superior court of the Canal Zone. It has the jurisdiction formerly exercised by the circuit courts of the Canal Zone and the original jurisdiction belonging to the Supreme Court of the Canal Zone, and all residuary jurisdiction not vested in the other courts. It is required to hold sessions at Balboa and at Cristobal. Its jurisdiction is similar in some respects to that of the Federal district courts of the United States in that admiralty and equity jurisdiction is conferred upon it, and this jurisdiction is to be exercised in the same manner and form as is done in the Federal district courts. In consequence, the blended system of practice prevailing in the courts of the Canal Zone heretofore has been abolished, and the dual system of practice of law and equity prevailing in the district courts of the United States substituted for it. It became necessary to define the territorial limits of the Ancon and Cristobal divisions of the district court. This was done by Executive order of March 12, 1914, which also contained a number of provisions relating to the procedure in the courts of the Canal Zone, including the magistrates' courts, as well as the district court.

Section 7 of the Panama Canal act authorizes the President to establish, by Executive order, all rules necessary to govern the disposition, treatment, and pardon of convicts. In conformity with that provision of the organic law, an Executive order was issued, on May 13, 1914, conferring power upon the Governor of The Panama Canal to remit fines and forfeitures, to grant pardons and reprieves and commutation of sentences, and to establish a system for paroling prisoners.

The radio stations located in the Canal Zone have been placed under the jurisdiction of the Navy Department, and pursuant to that order a site was set apart for the radio station at Balboa dump, to be known as Balboa Station, by Executive order of May 26, 1914. An Executive order has also been drafted, but not yet promulgated, setting apart the site near Caimito, to be known as the Darien Station.

A number of other Executive orders have been promulgated in addition to those above mentioned, such as the Executive order of March 2, 1914, establishing the Washington office of The Panama Canal, and the Executive order of March 20, 1914, providing a method for the determination and adjustment of claims for personal injuries to employees of The Panama Canal and the Panama Railroad, in conformity with section 5 of the Panama Canal act.

An Executive order was issued on April 16, 1914, establishing regulations relative to the payment of tolls, bills of material, supplies, etc., furnished to vessels by The Panama Canal.

ORGANIZATION.

On March 31, 1914, the law department of the Isthmian Canal Commission consisted of counsel and chief attorney, head of the department; a prosecuting attorney, an assistant prosecuting

attorney and land agent, and the clerical force of the department. The department as then constituted was abolished by the reorganization which took place on April 1, by virtue of the presidential order of January 27, 1914. Since April 1, 1914, the district attorney, appointed by the President under the provisions of the Panama Canal act, has had charge of all criminal prosecutions in court of the canal and the other legal affairs of The Panama Canal, except those which have been assigned to the special attorney appointed under the provisions of the sundry civil appropriation bill for the fiscal year 1914-15. And the legal matters of the Panama Railroad are now in charge of an attorney for the railroad on the Isthmus. All of these various activities were under the jurisdiction of the department of law of the Isthmian Canal Commission prior to the reorganization.

The land office has been placed under the jurisdiction of the special attorney until such time as the land claims now pending against the United States are disposed of. There has been no change in the organization of the land office.

A joint land commission, appointed under the Panama Canal treaty between the United States and the Republic of Panama, was in session on the Isthmus during the fiscal year from July 1 until about the middle of the month of September, when one of the American commissioners resigned, and his resignation was followed by that of the other American commissioner not long thereafter. This suspended the work of the commission to await the appointment of two new American members. The joint land commission, as then organized, heard and disposed of 1,253 claims. Of these 602 consisted of dismissals; 629 awards being made to various claimants; and disagreements of the commission were certified in 22 cases. During the same period this office adjusted and settled 752 claims, aggregating the sum of \$48,659, without the intervention of the joint land commission.

From the date of the discontinuance of the sessions of the joint land commission to the end of the fiscal year this office had adjusted 1,528 claims, aggregating the sum of \$96,080.50.

The settlement of claims made by this office, without the intervention of the joint land commission, during the fiscal year amounted to 1,903 settlements for claims of squatters, aggregating the sum of \$147,452.50. This makes the total number of claims settled by this office in the work of clearing the Canal Zone, under the presidential order of December 5, 1912, which clearing was started on January 1, 1913, amount to 2,237 claims, aggregating the sum of \$167,200.50.

Since that date the towns of Gorgona, Matachin, Bas Obispo, and Las Cascadas, as well as a number of smaller settlements, have been depopulated.

The sites on which the towns of Gorgona and Matachin were located are now largely inundated by the waters of Lake Gatun. The town site of Las Cascadas, and land adjacent thereto, has been dedicated to the purposes of the Tenth Infantry, now located there on the reservation known as Camp Otis.

On the 25th day of May, 1914, the joint land commission was reorganized with Messrs. Federico Boyd and Samuel Lewis, who served on the previous commission, and Messrs. Levi Monroe Kagy and David Marks, two new American members. Shortly after its reorgan-

ization the commission proceeded to the hearing of cases, and was progressing rapidly in the hearing of cases when the fiscal year ended.

The work of the commission was interrupted soon thereafter by the deplorable death of Commissioner Marks, which occurred at Ancon Hospital on July 17, 1914. Commissioner Marks was an earnest and industrious member of the commission. While not a lawyer, he possessed large practical business experience and manifested a sincere desire to resolve, in an equitable manner, all issues coming before the commission. At this date his successor has not yet been appointed.

The land office also has charge of all land matters relating to the Panama Railroad Co. The clearing of the Canal Zone has necessitated the cancellation of a number of leases from the Panama Railroad Co. to private individuals in the Canal Zone.

All leases for lots in the Empire and Culebra districts, which include the villages of Empire, New Empire, Camacho, Golden Green, New Culebra, Cow Pen, and West Culebra, were canceled on behalf of the Panama Railroad, effective June 30, 1914. In these districts there were 693 leases, covering about 739 lots, and the estimated annual rental value of these lots amounted to \$19,223.80.

At the same time leases for Panama Railroad Co.'s lots in the town of New Gatun were canceled, but the cancellations did not become effective until July 31 of this year. In this village there were 157 leases, covering 170 lots; the estimated annual rental derived from the lease of this property amounted to \$5,751.80. The total of all leases for these districts (Gatun, Empire, and Culebra) amounts to 850 leases, covering 909 lots, and the estimated rental value amounts to \$24,975.60. The leases in the Empire district were canceled by authority of the president of the Panama Railroad Co. under date of April 12, 1914, and the leases for lots in New Gatun were canceled by the same authority under date of June 10, 1914. Written notices were served on all lessees by the land agent of the Panama Railroad Co. The cancellation of these leases was made in connection with the general policy of clearing the Canal Zone.

There has been a slight increase in the number of lots leased by the company in the cities of Panama and Colon.

Thirty-seven new leases were issued on behalf of the Panama Railroad Co. for 46 new lots in the cities of Colon and Panama.

The Panama Railroad Co. had 232 agricultural leases to private parties during the fiscal year, covering property at Majagual and Escondido, which is that district on Panama Railroad lands lying east of the city of Colon. The rental value of these agricultural lands, as shown by the leases, aggregates the sum of \$1,422.70, but in fact no rentals are collected from the holders of leases in this area. The leases are in the nature of revocable licenses, and were obtained from the lessees in order to obtain a recognition from the lessees of the Panama Railroad Co. as the owner of the land.

A considerable number of revocable licenses were issued by the Panama Railroad Co. to people in the Huertas and Honduras tract, which lies east of the canal opposite Empire and Culebra. No rentals were collected from these licensees, and the licenses were revoked during the month of April last and the squatters removed from the property and compensated for their holdings by the canal authorities.

The total annual rental value of all leased property of the Panama Railroad Co. on July 1, 1914, amounted to \$130,645.09, which is a decrease of \$12,851.48 from estimated annual rental value of the fiscal year just ended. This decrease was occasioned by the cancellation of all the Empire and Culebra leases, effective June 30. The amount given is merely an estimated rental value for the fiscal year now current should the Panama Railroad Co. continue collecting rentals on all properties shown as being leased on July 1, 1914, at the rates indicated in the books of the company.

The actual rentals collected from all real properties of the Panama Railroad Co. during the fiscal year amounted to \$141,792.99, which is an increase of \$7,433.42 over the actual collections for the fiscal year 1912-13. This amount not only includes rentals collected from leased lots, but also rentals collected from the various buildings owned by the Panama Railroad Co. in Colon and Balboa.

A tabulated statement of the Panama Railroad leases, in effect July 1, 1914, is given below:

Location.	Leases.		Lots.		Rental.	
	June 30, 1913.	June 30, 1914.	June 30, 1913.	June 30, 1914.	June 30, 1913.	June 30, 1914.
Colon.....	772	824	807	936	\$90,790.28	¹ \$97,377.80
Fox River.....	71	72	70	71	4,157.00	4,211.00
Gatun.....	157	157	170	170	5,751.80	5,751.80
New Frijoles.....	24	24	27	27	377.00	377.00
Monte Lirio.....	10	10	15	15	414.00	414.00
Empire.....	403	(²)	441	-----	12,819.60	-----
Culebra.....	308	(²)	316	-----	6,774.40	-----
Panama.....	378	379	445	446	20,989.79	21,090.79
Agricultural.....	232	232	232	232	1,422.70	1,422.70
Total.....	2,355	1,698	2,523	1,897	143,496.57	130,645.09

¹ Includes rental from office in concrete building, Colon.

² Canceled, effective June 30, 1914.

The 157 leases in force in Gatun on July 1, 1914, terminated by cancellation on July 31, 1914.

CRIMINAL MATTERS.

As already stated in this report, the district attorney was appointed by the President, with the advice and consent of the Senate, soon after the reorganization took place on April 1, 1914, and the office of prosecuting attorney under the old organization ceased to exist. All criminal business since the appointment of the district attorney has been under his control and direction, but in making this report the criminal matters for the entire year are included. Four hundred and sixty-four criminal cases were disposed of during the fiscal year; of these 204 were disposed of in the circuit court of the first circuit, 106 in the circuit court of the second circuit, and 86 in the circuit court of the third circuit, and after the organization of the district court under the Panama Canal act 21 cases were disposed of at the Cristobal division of the district court, and 51 cases at the Balboa division of the district Court, making in all 464 criminal cases disposed of. There were 328 convictions, 103 acquittals, 23 dismissals,

and in 9 cases the accused parties are fugitives from justice. In addition, two cases of extradition were disposed of. In one the party was extradited to the United States, and in the other to Panama. Besides these there were two cases of parties, indicted in the Federal court at New York, and the parties arrested on the Isthmus, making in all a total of 468 cases.

A tabulated statement is given below showing the various offenses involved in these cases, and this tabulated statement is followed by tabulated statements for the years 1911-12, and the years 1912-13, for purposes of comparison:

Criminal prosecutions, 1913-14.

Adultery.....	8
Assault and battery.....	6
Assault with a deadly weapon.....	29
Assault with intent to commit murder.....	2
Assault with intent to commit felonies other than murder.....	9
Attempt to defraud.....	9
Battery.....	9
Burglary.....	27
Disorderly conduct.....	22
Embezzlement.....	10
False personation.....	10
Forgery.....	20
Fraud.....	3
Gambling.....	56
Grand larceny.....	123
Liquor laws, violation of.....	6
Loitering.....	12
Manslaughter.....	3
Manslaughter, involuntary.....	1
Navigation rules, violation of.....	8
Perjury.....	2
Petit larceny.....	18
Rape.....	2
Returning to Canal Zone after deportation.....	7
Sanitary regulations, violation of.....	4
Miscellaneous.....	62
Total.....	468
Disposition:	
Convicted.....	329
Acquitted.....	103
Dismissed.....	23
Fugitive.....	9
Extradited to United States.....	1
Extradited to Panama.....	1
Miscellaneous.....	2
Total.....	468
Number by circuits:	
First circuit.....	204
Second circuit.....	106
Third circuit.....	86
Cristobal district.....	21
Balboa district.....	51
Total.....	468

Criminal prosecutions, 1911-12.

Adultery.....	9
Arson.....	5
Assault and battery.....	28

Assault with a deadly weapon.....	67
Assault with intent to commit murder.....	4
Assault with intent to commit felonies other than murder.....	5
Burglary.....	62
Cheats.....	13
Disorderly conduct.....	17
Embezzlement.....	24
Forgery.....	17
Gambling.....	66
Grand larceny.....	107
Manslaughter.....	4
Murder.....	3
Navigation laws, violation of.....	26
Perjury.....	6
Rape.....	7
Resisting, etc., public officer.....	17
White-slave traffic.....	6
Miscellaneous.....	122
Total.....	615
Disposition:	
Convicted.....	398
Acquitted.....	139
Dismissed.....	66
Fugitives.....	12
Total.....	615
Number by circuits:	
First circuit.....	160
Second circuit.....	333
Third circuit.....	122
Total.....	615

Criminal prosecutions, 1912-13.

Adultery.....	18
Arson.....	1
Assault and battery.....	51
Assault with a deadly weapon.....	27
Assault with intent to commit murder.....	4
Assault with intent to commit felonies other than murder.....	5
Burglary.....	53
Cheats.....	5
Disorderly conduct.....	27
Embezzlement.....	24
False personation.....	3
Forgery.....	24
Gambling.....	100
Grand larceny.....	124
Incest.....	2
Liquor laws, violation of.....	9
Manslaughter.....	5
Mayhem.....	1
Murder.....	2
Murder, second degree.....	1
Navigation rules, violation of.....	19
Perjury.....	1
Petit larceny.....	27
Rape.....	3
Receiving stolen property.....	2
Returning to Canal Zone after deportation.....	13
Rioting.....	8
Miscellaneous.....	62
Total.....	621

Disposition:

Convicted.....	449
Acquitted.....	111
Dismissed.....	54
Fugitives.....	7
Total.....	621

Number by districts:

First circuit.....	288
Second circuit.....	178
Third circuit.....	155
Total.....	621

Summary of criminal prosecutions for the fiscal years 1911-1914.

	1911-12	1912-13	1913-14
Adultery.....	9	18	8
Arson.....	5	1	.....
Assault and battery.....	28	61	6
Assault with deadly weapon.....	67	27	29
Assault with intent to commit murder.....	4	4	2
Assault with intent to commit felonies other than murder.....	5	5	9
Attempt to defraud.....	.....	.....	9
Battery.....	.....	.....	9
Burglary.....	62	53	27
Disorderly conduct.....	17	27	22
Embezzlement.....	24	24	10
False personation.....	.....	3	10
Forgery.....	17	24	20
Fraud.....	13	5	3
Gambling.....	66	100	56
Grand larceny.....	107	124	123
Incest.....	.....	2	.....
Liquor laws, violation of.....	.....	9	6
Loitering.....	.....	.....	12
Manslaughter.....	4	5	3
Manslaughter, involuntary.....	.....	.....	1
Mayhem.....	.....	1	.....
Murder.....	3	2	.....
Murder, second degree.....	.....	1	.....
Navigation rules, violation of.....	26	19	8
Perjury.....	6	1	2
Petit larceny.....	.....	27	18
Rape.....	7	3	2
Receiving stolen property.....	.....	2	.....
Resisting, etc., public officer.....	17	.....	.....
Returning to Canal Zone after deportation.....	.....	13	7
Rioting.....	.....	8	.....
Sanitary regulations, violation of.....	.....	.....	4
White-slave traffic.....	6	.....	.....
Miscellaneous.....	122	62	62
Total.....	615	621	468

The number of criminal cases disposed of during the fiscal year just ended shows a decrease in crime as compared with the previous year of 153 cases. This is doubtless due to the decrease in population in the Canal Zone.

There were three criminal cases heard and disposed of by the supreme court. In two cases the sentences of the lower trial court were affirmed, and in the other case the judgment of the lower court was reversed.

The number of civil cases in which the United States, the Isthmian Canal Commission, or the Panama Railroad Co. were interested, disposed of and pending at the end of the fiscal year, was about the same as that for the fiscal year 1912-13.

The following statement shows the cases for the fiscal year just ended:

CIVIL CASES IN THE CANAL ZONE COURTS IN WHICH THE UNITED STATES AND THE PANAMA RAILROAD CO. ARE INTERESTED.

Cases disposed of during fiscal year ended June 30, 1914.

IN THE FIRST CIRCUIT COURT.

J. M. Walker v. Panama Railroad Co.—This was a suit for \$5,000 damages for personal injuries. Complaint filed July 7, 1913. Judgment in favor of defendant, August 30, 1913. Appealed to the Supreme Court.

IN THE SECOND CIRCUIT COURT.

Manuel Lopez v. Panama Railroad Co.—This was a suit for \$20,000 damages for personal injuries. Complaint filed January 17, 1914. Verdict and judgment in favor of plaintiff, March 20, 1914, for \$3,500. Paid.

IN THE THIRD CIRCUIT COURT.

James Arthurton v. Panama Railroad Co.—This was a suit for \$10,000 for personal injuries. Complaint filed November 15, 1912. Subsequently an amended complaint was filed and case continued until July 10, 1913. Verdict and judgment for \$1,500 rendered against defendant. Paid.

Hezekiah Carter v. Panama Railroad Co.—This was a suit for \$5,000 damages for personal injuries. Complaint filed April 28, 1913. There was a demurrer by the defendant which was sustained, and amended complaint filed. The case was tried on July 3, 1913, and verdict and judgment rendered in favor of defendant.

James Beckford v. Panama Railroad Co.—This was a suit for \$10,000 for personal injuries. Complaint was filed September 29, 1913. Answer filed, and on February 26, 1914, plaintiff asked for and was granted a nonsuit without prejudice.

Fenne Coverly v. Panama Railroad Co.—This was a suit for \$10,000 for personal injuries. Complaint filed February 2, 1914. Answer was filed and on March 12, 1914, plaintiff asked for a nonsuit without prejudice.

Richard Husbands v. Panama Railroad Co.—This was a suit for \$5,000 damages for personal injuries. Complaint filed and on June 4, 1914, plaintiff accepted \$25 in full settlement and case was dismissed.

IN THE SUPREME COURT OF THE CANAL ZONE.

Thull, administrator, v. Panama Railroad Co.—This was a suit for \$20,000 damages for personal injuries resulting in death. This case was tried in the second circuit court, and verdict and judgment rendered in favor of defendant. The case was appealed to the supreme court and on September 24, 1913, the verdict and judgment of the circuit court was affirmed by the supreme court.

Evan Weeks v. Panama Railroad Co.—This was a suit for \$10,000 for personal injuries. The case was tried in the second circuit court and resulted in a verdict and judgment in favor of plaintiff in the sum of \$5,000. Defendant appealed the case to the supreme court and October 4, 1913, the verdict and judgment of the lower court was reversed, and the second circuit court was directed to enter a verdict and judgment in favor of defendant.

J. M. Walker v. Panama Railroad Co.—This was a suit for \$5,000 for personal injuries, in the first circuit court. Verdict and judgment were rendered in favor of defendant and the case was appealed to the supreme court; on January 12, 1914, plaintiff withdrew his appeal.

Civil cases pending at the beginning of fiscal year July 1, 1914-15.

IN THE DISTRICT COURT, BALBOA DIVISION.

George Joseph v. Panama Railroad Co.—This was a suit for \$7,500 damages for personal injuries. Complaint filed June 15, 1914. Answer was filed and case is ready for trial.

IN THE DISTRICT COURT, CRISTOBAL DIVISION.

Adras Mompoint, administrator, v. Panama Railroad Co. and Munson Steamship Line.—This is a suit for \$10,000 for personal injuries. Complaint filed in the third circuit court February 19, 1914. Answer filed and on April 1, 1914, the case was transferred to Cristobal division of the district court and is ready for trial.

Samuel Anderson v. Panama Railroad Co.—This is a suit for \$5,000 damages for personal injuries. Complaint filed March 13, 1914, and answer filed. On April 1, 1914, it was transferred from the third circuit court to the Cristobal division of the district court. Case is ready for trial and has been set down for hearing August 13, 1914.

Maria J. Arpon v. Panama Railroad Co.—This is a suit for \$500 damages for loss of trunk. Filed June 20, 1914. Answer filed and case is ready for trial.

Guisepe Voza, administrator, v. Panama Railroad Co.—This was a suit for \$20,000 for personal injuries, resulting in death. Complaint filed May 26, 1914. Defendant filed plea of statute of limitations. Argument on plea heard by court, but no decision has been rendered at this date.

Eusebio Morales et al. v. Reuben Arcia et al.—This was a suit instituted by Morales and others against Arcia and others for partition of lands lying between Gatun and Colon. The Isthmian Canal Commission and the Panama Railroad Co. intervened and set up title to the land. The case was tried, and on May 31, 1913, an opinion was rendered by the court giving certain portions of the lands to the plaintiffs and defendants and other portions to the Panama Railroad Co. and Isthmian Canal Commission. On the 31st day of May, 1913, the court entered its decree. Subsequently writ of possession was asked for, but denied by the judge of the third circuit court in an oral opinion. On April 1, 1914, this case was, by the Panama Canal act, transferred to the Cristobal division of the district court. Another application will be made to the court for a writ of possession.

Pedro Celestino Cerezo v. Diaz and others.—This was a case involving land at the mouth of the Sweetwater River at Toro Point, across the bay from Colon, and includes part of lot 1 of the Harrison-Arosemena map granted to the Panama Railroad Co. by the Colombian Government. The United States and the Panama Railroad Co. intervened in the case, and negotiations for compromise have been pending for some time. On April 1, 1914, this case was transferred to the Cristobal division of the district court.

Panama Railroad Co. v. Mendes et al.—This is a suit to recover a tract of land lying northeast of the city of Colon, consisting of about 10,000 acres. The complaint was filed March 21, 1912, and demurrer interposed by defendants, which was overruled. Answer has been filed and the case has been continued from time to time by the defendants. On April 1, 1914, this case was transferred to the Cristobal division of the district court of the Canal Zone.

Panama Railroad Co. v. Villalobos et al.—This is a suit to recover a strip of land on the shore of Limon Bay. Complaint was filed March 21, 1912. Demurrer was filed by defendants, which was overruled. Answer has been filed and on April 1, 1914, the case was transferred to the Cristobal division of the district court.

CLAIMS DISPOSED OF WITHOUT SUIT.

Claim of Ferdinand Daisey.—For loss of trunk. Compromised for \$46.

Miss Ada Ganaway.—Claim for personal injuries to passenger. Settled for \$125.

Nathan Benjamin.—Claim for damages for personal injuries to employee. Settled for \$1,000.

Hubert Grimes and wife.—Claim for damages for personal injuries to passenger. Settled for \$600.

The public records relating to the public lands owned by the Panama Railroad Co. in the Canal Zone and the Republic of Panama, as well as those formerly owned by the French company, but now owned by the United States, are to be found in Bogota. The law department of the Isthmian Canal Commission was able to obtain some of those records from the archives of the Republic in the city of Panama which were of material assistance to the railroad company in the suits instituted on its behalf to recover lands from persons unlawfully in possession of them. But there are many more records in Bogota of value to the United States and the railroad company. Efforts have been made through the State Department and the American minister at Bogota to obtain these records without success. It is to be hoped that in the near future, if not the original documents, at least certified copies of them will be obtained from Colombia for the protection of the landed interests of the United States in the Canal Zone.

A great deal of the land owned by the Panama Railroad Co. has been taken by the United States for the purposes of the canal, and now, in carrying out the presidential order of depopulation, it will be necessary to take over the remaining lands of the railroad company. Some of these lands, however, are in litigation with private parties, and I recommend that these be not taken over by the Government until the issues between the railroad company and the private parties have been adjusted in the pending suits.

Respectfully,

FRANK FEUILLE, *Special Attorney.*

To Col. GEO. W. GOETHALS, United States Army,
Governor of The Panama Canal, Balboa Heights, Canal Zone.

APPENDIX J.

REPORT OF THE GENERAL PURCHASING OFFICER AND CHIEF OF THE WASHINGTON OFFICE.

THE PANAMA CANAL,
Washington Office, July 20, 1914.

SIR: I have the honor to submit the following report upon the work of this office during the fiscal year ending June 30, 1914:

The only changes made in the organization of the office during the past year have been those resulting from the abolishment of the disbursing office and placing a disbursing clerk under the assistant auditor, whose office was established in place of the office of the assistant examiner of accounts, which changes were made effective April 1, 1914, under the provisions of the Executive order of March 2, 1914, quoted below.

The following divisions are now under my charge as general purchasing officer and chief of the Washington office of The Panama Canal: General office, office of assistant auditor, appointment division, correspondence and record division, and the purchasing department.

The following is the Executive order referred to above:

EXECUTIVE ORDER.

To establish a Washington Office of The Panama Canal, to provide temporarily for the organization, officials and employes thereof, and to continue in force for The Panama Canal rules, regulations, and executive orders which may have been made for the Isthmian Canal Commission.

By virtue of the authority vested in me it is hereby ordered:

SECTION I.

That an office of The Panama Canal is established in the City of Washington in the District of Columbia.

SECTION II.

That the Washington Office of the Panama Canal shall be the office of general records in the United States, and shall succeed to the custody, care and preservation of all the records and files of the Isthmian Canal Commission, to be retained and preserved in the United States on and after April 1, 1914, and shall also succeed to and become chargeable with all property of every kind and character purchased for the Washington Office of the Isthmian Canal Commission, which is on hand April 1, 1914.

SECTION III.

That the Washington Office of The Panama Canal shall be the headquarters and the principal office of the Purchasing Department of The Panama Canal. The head of the Purchasing Department of The Panama Canal, under the direction of the Governor, shall have administrative control of the Washington Office of The Panama Canal. He shall be subject to orders and supervision of the Chief of Engineers of the U. S. Army to such extent as may be directed by the Secretary of War. He shall be General Purchasing Officer for The Panama Canal, and shall also act as the Chief of the Washington Office of The Panama Canal.

SECTION IV.

That until further ordered, the Washington Office of The Panama Canal shall have the same organization as to offices and departments (except the Office of the Assistant Examiner of Accounts and the Disbursing Office) as the Washington Office of the Isthmian Canal Commission shall have on March 31, 1914. The number, class and salaries of officials and employes in each of the offices and departments, except as hereinafter provided, shall be the same as those authorized for the Washington Office of the Isthmian Canal Commission on March 31, 1914, and any change in the salary of any position, or in the number of positions in any office or department, shall be made only as now provided by law. The officers and employes, except as hereinafter provided, shall perform the same class of duties that they may be assigned to on March 31, 1914.

SECTION V.

That the Assistant Auditor provided for in Executive Order No. 1885, dated January 27, 1914, shall be appointed April 1, 1914. His salary shall be fixed by the Governor. He shall perform such duties of the Accounting Department to be performed in the United States, as may be assigned to him by the Auditor, and also such other duties of a general nature as may be assigned to him by the Chief of the Washington Office of The Panama Canal.

On and after April 1, 1914, there shall be transferred to the Assistant Auditor, and he shall be charged with the custody, care and preservation of, all records and property of the Disbursing Officer and of the Assistant Examiner of Accounts of the Isthmian Canal Commission, with which those officers shall be charged on March 31, 1914.

The Chief of the Washington Office may, however, transfer to and place in the custody of the Disbursing Clerk, hereinafter provided for, such of the property and records above described, as he may deem to be essential to enable the Disbursing Clerk to properly perform his duties under this order, but the Disbursing Clerk shall not be permitted, without specific authority from the Chief of Office, to keep a separate set of records and files. He shall be required to rely upon, and consult when necessary, the records and files in the office of the Assistant Auditor, in verifying the legality of claims and accounts submitted to him for payment, or to verify the details of any collection for which he is required to account. Disbursements will be made by the Disbursing Clerk only after examination of the claim or account in the office of the Assistant Auditor.

Such of the officers and employes employed in the office of the Assistant Examiner of Accounts and the Disbursing Office of the Isthmian Canal Commission on March 31, 1914, as the Governor determines to retain, shall be transferred to and employed in the Accounting Department in the United States, and their salaries fixed at such amounts as the Governor deems just and reasonable.

There shall be a Disbursing Clerk for that part of the Accounting Department in the United States, who shall perform similar duties to those that are required to be performed by the Collector and Paymaster on the Isthmus, in so far as there are such duties to be performed in the United States, and shall be subject to the same supervision by the Assistant Auditor, as the Collector and Paymaster on the Isthmus are by the Auditor. He shall give bond in such amount as may be fixed by the Governor, or by his authority.

Such of the officers and employes as are transferred to and employed in the Accounting Department in the United States, shall be distributed between the office of the Assistant Auditor and that of the Disbursing Clerk, respectively, as the needs of the service require. They shall perform such duties as may be assigned to them by proper authority. They shall be subject to similar financial responsibilities, and to the same general rules and regulations that have been prescribed for like officers and employes employed in the Accounting Department on the Isthmus.

It is the purpose of this order, and it shall be so construed, as to require the Assistant Auditor of The Panama Canal to examine all claims and accounts before their payment by the Disbursing Clerk; to carry on all general correspondence in relation to claims and accounts required to be conducted by the Accounting Department in the United States; to prepare all vouchers and certify to the validity of all claims and accounts before they are submitted to the Disbursing Clerk for payment; to furnish to the Disbursing Clerk all necessary data to enable that officer to make reply to any exceptions that may be taken to his account by the Auditor for the War Department; to keep all general records required to be kept in the Accounting Department in the United States; to make all reports as to statistical data required to be sent to the Auditor on the Isthmus; to give an administrative examination to all accounts of the Disbursing Clerk before they are transmitted to the Auditor; to make an administrative

examination of all claims which are to be submitted to the Auditor for direct settlement; to keep a complete record of all collections to be made and all moneys received by the Disbursing Clerk; to certify to the correctness of the Disbursing Clerk's accounts for collections; to see that bills collectible are issued and collections made in all proper cases; to have charge of all general files which are required to be kept by the Accounting Department in the United States; and to perform such other duties as may be assigned to him by the Auditor, or the Chief of the Washington Office.

SECTION VI.

That any person holding appointment or employment in or under the Washington Office of the Isthmian Canal Commission on March 31, 1914, shall be eligible for appointment to, or employment in a like position in or under the Washington Office of The Panama Canal, created by this order, and all except those employed in the Accounting Department, will be considered to be transferred and appointed to such like position in or under the Washington Office of The Panama Canal, as of April 1, 1914, without further order or appointment. The oath of office shall be taken by all officials and employes of the Washington Office.

SECTION VII.

This order shall remain in force as a provisional order only, for the establishment of the Washington Office of The Panama Canal, until an order for the permanent organization of such office shall have been made.

SECTION VIII.

All rules, regulations and executive orders, not inconsistent with the provisions of this order and the Executive Orders of January 27, and February 2, 1914, heretofore made for the Isthmian Canal Commission, and applicable to conditions that will exist under these orders, shall be and are hereby continued in full force and effect, as rules, regulations, and executive orders for the government of officers and employes of The Panama Canal and the transaction of the business of The Panama Canal.

WOODROW WILSON

THE WHITE HOUSE, 2 March, 1914.

[No. 1897.]

The work of the appointment division has continued heavy throughout the year, the number of appointments being in excess of the number for the preceding year. During the last 12 months 2,248 persons within the United States were tendered employment for duty on the Isthmus in grades above that of laborer; 1,429 accepted and were appointed, covering 71 different positions. Four thousand one hundred and forty persons, including new appointees, those returning from leave of absence, members of employees' families, and employees of contractors and their families, were provided with transportation from the United States to the Isthmus; and in response to inquiries and applications for employment during this period, and in the issuance of appointments, 21,827 letters were written, 4,161 telegrams sent, and 21,607 circulars mailed.

The work of the correspondence and record division, comprising all general or administrative correspondence and miscellaneous matters, has been continued along the lines described in previous annual reports, there being, however, a marked increase in the amount of work done, the result of correspondence relating to new questions connected with the near approach of the opening of the canal and its operation.

As above stated, the disbursing office and the office of the assistant examiner of accounts, Isthmian Canal Commission, were combined under the office of the assistant auditor of The Panama Canal on April 1, 1914.

The combined statement given below shows the work of these two offices and of the office of the assistant auditor of The Panama Canal for the fiscal year ending June 30, 1914:

Claim statement, July 1, 1913, to Mar. 31, 1914.

On hand July 1, 1913.....	\$344
Received July 1, 1913, to Mar. 31, 1914.....	12, 891
Total.....	13, 235
Passed for payment July 1, 1913, to Mar. 31, 1914.....	12, 714
On hand, as per report of disbursing officer, Mar. 31, 1914.....	521

Claim statement, Apr. 1, 1914, to June 30, 1914.

On hand Apr. 1, 1914, as per claims turned over to the assistant auditor	\$791
Received Apr. 1, 1914, to June 30, 1914.....	4, 750
Total.....	5, 541
Passed for payment Apr. 1, 1914, to June 30, 1914.....	4, 809
On hand June 30, 1914.....	732

Consolidated claim statement.

On hand July 1, 1913.....	344
Received July 1, 1913, to June 30, 1914	17, 911
Total.....	18, 255
Passed for payment July 1, 1913, to June 30, 1914.....	17, 523
On hand June 30, 1914.....	732

Financial statement of transactions of the disbursing officer of the Isthmian Canal Commission from July 1, 1913, to Mar. 31, 1914.

On hand July 1, 1913.....	\$472, 772. 74
Receipts:	
From United States Treasury.....	\$11, 000, 000. 00
Miscellaneous collections.....	70, 061. 33
	<u>11, 070, 061. 33</u>
	<u>11, 542, 834. 07</u>
Disbursements:	
Claims paid.....	10, 696, 752. 96
Deposits.....	27, 692. 30
	<u>10, 724, 445. 26</u>
Balance deposited in United States Treasury.....	818, 388. 81
	<u>11, 542, 834. 07</u>

Financial statement of receipts and disbursements in the assistant auditor's office from Apr. 1, 1914, to June 30, 1914.

Receipts:	
Advance to disbursing clerk from United States Treasury.....	\$4, 000, 000. 00
Miscellaneous collections.....	19, 021. 95
	<u>\$4, 019, 021. 95</u>
Disbursements:	
Paid by disbursing clerk.....	3, 918, 291. 82
Deposited in United States Treasury.....	18, 557. 12
Balance on hand June 30, 1914.....	82, 173. 01
	<u>4, 019, 021. 95</u>

Financial statement, combined accounts of the disbursing officer of the Isthmian Canal Commission and of the disbursing clerk of The Panama Canal from July 1, 1913, to June 30, 1914.

On hand July 1, 1913.....		\$472, 772. 74
Receipts:		
From United States Treasury.....	\$15, 000, 000. 00	
Miscellaneous collections.....	89, 083. 28	
		15, 089, 083. 28
		15, 561, 856. 02
Disbursements:		
Claims paid.....	14, 615, 044. 78	
Deposited in United States Treasury.....	864, 638. 23	
		15, 479, 683. 01
Balance on hand June 30, 1914.....		82, 173. 01
		15, 561, 856. 02

During the fiscal year 14,247 vouchers for payments, amounting to \$14,615,044.78, and 600 direct settlements and settlements by transfer of appropriation, aggregating about \$132,000, were given an administrative examination.

The assistant examiner of accounts, up to March 31, 1914, and the assistant auditor, since that date, continued the performance of the duties specified in the last annual report as being regularly performed by the assistant examiner of accounts.

The purchasing department has been continued as heretofore organized under the supervision of the Chief of Engineers, United States Army, and in direct charge of an officer of the Corps of Engineers as general purchasing officer, with headquarters at Washington, D. C. The principal purchases are made from the Washington office, with assistant purchasing agents located at New York, New Orleans, and San Francisco, these latter offices being also used for receiving and shipping of such materials as are purchased for forwarding to the Isthmus through their respective ports. A small force of employees is maintained in the medical supply depot of the United States Army, New York, in which office the purchases of medical and hospital supplies are made, under the officer in charge of the depot.

The same general system of purchasing through circular invitations to bid prevails as described in previous annual reports, these circulars being advertised in newspapers and distributed through the offices of the assistant purchasing agents and the field officers of the Corps of Engineers, United States Army, located throughout the United States, through which sources of information, in connection with newspaper advertising, manufacturers and dealers throughout the country may obtain the circulars and such specifications and other necessary data as will enable them to submit proposals and make deliveries through the nearest ports. The system of annual contracts has been continued, but has been reduced to such staple articles as will be used after the completion of the canal. Every effort has been made to reduce the quantity of materials carried in stock to the lowest possible amount, in order to prevent an excess remaining on hand after the completion of the construction work.

A corps of inspectors under the direction of the inspecting engineer located in Washington is maintained and all materials purchased

are passed on before shipment to the Isthmus. Assistance in inspection has also been rendered by the field officers of the Corps of Engineers. Practically all of the independent inspection forces which were necessary and located at points outside of Washington, for the past four or five years, have been eliminated or greatly reduced, as the work on the lock gates and electrical machinery has been practically completed. The work of inspection has been greatly facilitated by assistance rendered The Panama Canal by the Bureau of Standards, the Bureau of Mines, the Bureau of Chemistry, and the Medical Department, the Ordnance Department, and the Quartermaster Corps of the United States Army.

Because of the efforts made to reduce the supply of materials on the Isthmus to a minimum and purchase only such equipment as would actually be required in the construction, the work of the purchasing department and its branches has been even greater this year than heretofore, the number of orders placed by the Washington office during the past fiscal year being 7,426 as compared with 7,087 the year before and 5,960 during the fiscal year 1911-12.

The total value of equipment and materials purchased was \$12,392,407.78, approximately the same as the previous year when the purchases amounted to \$12,335,973.12. Included in this amount are contracts for permanent equipment, including chain fenders and chain, \$192,865.90; coal-handling plants, \$1,929,103.85; terminal facilities and docks, \$224,004.44; floating caisson, \$333,851.20; one single-track movable span bridge, \$55,674; transmission line, \$505,511.84; filtration plants, \$150,576.79; material and equipment for buildings and quarters, \$53,824.02; Balboa shops, buildings, \$155,547.89—machinery, \$146,367.16; two 12-thousand ton colliers, \$1,975,000; two tugboats, \$304,000; 9 gasoline motor boats and launches, \$54,392. Other items of purchase included 2,450,000 pounds of explosives; 22,200,000 feet of lumber; 20,000 cross ties; and 18,311 piles. Shipments of cement were continued during the year under contract entered into January 7, 1909, and September 13, 1912, amounting to 592,674 barrels and making a total of 6,250,460 barrels delivered under this contract.

Very respectfully,

F. C. BOGGS,
Major, Corps of Engineers, United States Army,
General Purchasing Officer, Chief of Office.

Col. GEO. W. GOETHALS, United States Army,
Governor of The Panama Canal, Culebra, Canal Zone.

APPENDIX K.

TABLES SHOWING INCREASES IN SALARIES AUTHORIZED OVER ORGANIZATION OF JULY 1, 1912, AND INCREASES OF NUMBERS OF PERSONS EMPLOYED OVER NUMBER ALLOWED IN 1914 BOOK OF ESTIMATES, AS REQUIRED BY ACT OF CONGRESS APPROVED JUNE 23, 1913.

DEPARTMENT OF OPERATION AND MAINTENANCE.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
ELECTRICAL DIVISION.					
Electrical engineer, \$1,320, in addition to \$2,880, Army pay.				1	Organization of electrical division Apr. 1, 1914.
Electrical recorder, \$1,800.....				1	In lieu of 2 station recorders, at \$1,650 each.
Crane operator, \$1,200.....				11	Operation Balboa cargo-handling cranes. Apparently omitted from 1914 Book of Estimates by mistake.
LOCKS SUBDIVISION.					
Diver, \$2,488.....				1	Work in connection with the installation of lock machinery and cleaning up lock chambers, etc.
Wireman, \$1,393.28.....			51	101	Increased by changing 50 erector positions to wiremen account of advancing date of completion of the electrical installation at the locks.
General foreman, \$2,400.....	\$1,980	\$2,400	15	16	To rush date of completion of electrical work at Miraflores Locks. This was effective May 1, 1913, but omitted from 1913 report.
DIVISION OF MUNICIPAL ENGINEERING.					
Carpenter, 65 cents per hour.....				12	(*)
Chemist, \$1,800.....				4	(*)
Clerk, chief, \$2,400.....				1	(*)
Clerk, \$1,950.....				1	(*)
Clerk, \$1,800.....				1	(*)
Clerk, \$1,500.....				2	(*)
Draftsman, \$2,400.....				1	(*)
Engineer (resident), \$6,000.....				1	(*)
Engineer (assistant), \$2,700.....				1	(*)
Engineer (steam), \$1,800.....				2	(*)
Foreman (general), \$2,400.....				1	(*)
Foreman (general), \$2,100.....				6	(*)
Foreman, \$1,950.....				1	(*)
Foreman, \$1,800.....				14	(*)
Foreman, \$1,650.....				2	(*)
Foreman, \$1,500.....				6	(*)
Inspector, chief, plumbing, \$2,400.....				1	(*)
Operator, pump, \$1,620.....				9	(**)
Physiologist.....	2,400	2,700			(***)
Supervisor, \$2,700.....				1	(*)

All items marked (*) were due to reorganization, effective July 16, 1913, and to new work in connection with construction of new water-works system for the southern end of the canal. The municipal work in the Atlantic, Central, and Fifth divisions was consolidated and together with the work of the public works division was given to a new division of municipal engineering. The work of constructing the new water works for the southern end of the canal was undertaken by the division of municipal engineering during the fiscal year 1914, and this necessitated a big increase in the number of foremen and carpenters over those included in the 1914 book of estimates, and this work had not been authorized at the time that the book of estimates was published.

Item marked (**) is due to increase in number of electric pumps and decrease in number of steam pumps. Three of these were temporary, for about three months on account of Pedro Miguel pump station.

Item marked (***) is due to increased duties and responsibilities, being given charge of analyses of water supplies in all of the Canal Zone.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION.					
OFFICE OF ENGINEER OF TERMINAL CONSTRUCTION.					
Clerk, \$1,500.....				1	Necessary on account of increase in office work.
DESIGN OF QUAY WALLS AND PIERS.					
Assistant engineer, \$3,000.....				1	Promoted from junior engineer at \$2,700 to conform to rating in effect in other divisions for similar duties.
PERMANENT FUEL OIL HANDLING PLANTS.					
Assistant engineer, \$3,000.....				1	Employed Jan. 6, 1914, for design and erection of permanent fuel-oil storage plants.
Draftsman, \$1,800.....				1	Transferred June 1, 1914, to subdivision of oil plants from design of permanent shop buildings.
PERMANENT SHOP DESIGN.					
Draftsman, \$2,100.....				1	Temporarily employed on design of permanent shop buildings.
Draftsman, \$1,800.....				1	
Draftsman, \$1,650.....				2	
Draftsman, \$1,500.....				2	
BALBOA TOWN-SITE SUBDIVISION.					
Landscape architect, \$3,000				1	For work on Balboa town site.
Draftsman, \$1,800.....				1	Do.
Clerk, \$1,800.....				1	Do.
Junior engineer, \$2,400.....				1	Do.
Transitman, \$2,100.....				1	Do.
Transitman, \$1,800.....				1	Do.
Levelman, \$1,500.....				2	Do.
Rodman, \$1,000.....				2	Do.
General foreman, \$2,100.....				2	Do.
Foreman, \$1,800.....				4	Do.
Foreman, \$1,500.....				3	Do.
Steam engineer, \$1,620.....				2	Do.
PACIFIC TERMINALS.					
Clerk, \$1,800.....			3	4	Increased clerical work on account of the property accountability being transferred from the old fifth division to the division of terminal construction, Pacific terminals.
Clerk, \$1,500.....			1	2	On account of Ancon quarry work being turned over to the division of terminal construction, Pacific terminals. This position was only filled for about 1 month after the quarry was taken over by this division.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
PACIFIC TERMINALS—contd.					
Transit man, \$2,100.....			3	4	On account of it being necessary to have one complete party for checking and miscellaneous work which was not considered necessary at the time organization was submitted.
Levelman, \$1,500.....			3	4	
Rodman, \$1,000.....			3	4	
Superintendent, \$3,000.....				1	On account of dismantling and reerecting berm crane.
Supervisor, \$3,000.....				1	On account of Ancon quarry being turned over to the division of terminal construction, Pacific terminals.
Foreman (general) \$2,400.....			7	11	On account of Ancon quarry, Sosa Hill quarry, and Naos Island Breakwater being turned over to the division of terminal construction, Pacific terminals; also on account of permanent shops, tracks, and grading and back filling.
Foreman (general), \$2,100.....			17	21	On account of Ancon quarry and Naos Island Breakwater being turned over to the division of terminal construction, Pacific terminals.
Foreman, \$1,980.....			9	10	On account of Sosa quarry being turned over to the division of terminal construction, Pacific terminals.
Foreman, \$1,800.....			44	49	On account of Ancon quarry and Sosa quarry being turned over to the division of terminal construction, Pacific terminals.
Foreman, \$1,500.....			35	36	On account of Naos Island Breakwater being turned over to the division of terminal construction, Pacific terminals.
Engineer (steam shovel). \$2,520			7	12	On account of Sosa quarry and Ancon quarry being turned over to the division of terminal construction, Pacific terminals.
Craneman (steam shovel). \$2,220			7	12	
Wireman, blasting, \$1,500.....				1	On account of Sosa quarry being taken over by the division of terminal construction, Pacific terminals.
CRISTOBAL COALING STATION. ¹					
Superintendent, \$3,600.....				1	All positions shown are increases, due to the development of work. The positions were not shown in 1914 Book of Estimates.
Junior engineer, \$2,400.....				1	
Foreman (general), \$2,400.....				5	
Foreman (general), \$2,100.....				1	
Foreman, \$1,950.....				3	
Foreman, \$1,800.....				16	
Foreman, \$1,500.....				4	
Clerk, \$2,100.....				1	
Clerk, \$1,800.....				2	

¹ Positions not authorized in organization of July 1, 1912.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
CRISTOBAL COALING STATION—continued.					
Levelman, \$1,500				2	
Draftsman, \$1,800				1	
Transit man, \$2,100				2	
Draftsman, \$1,500				1	
Rodman, \$1,000				4	
Blacksmith, \$1,617.20				1	
Carpenter, \$1,617.20				5	
Carpenter, \$1,398.28				5	
Diver, \$1 per hour				1	
Engineer, steam, \$1,800				9	
Hostler, \$1,680				1	
Ironworker, \$1,617.20				1	
Machinist, \$1,617.20				2	
EAST BREAKWATER SUB-DIVISION.					
Supervisor	\$2,700	\$3,000			Due to increased duties and responsibilities.
Clerk, \$2,100				1	Due to transfer of office from Dock 13 to Coca Solo.
Carpenter, \$1,617.20				1	Due to sawing up second-hand lumber for East Breakwater.
Steam engineer	1,500	1,650			Increase of 2 after six months' satisfactory service.
DREDGING DIVISION.					
Clerk, \$2,100				1	Account transfer of property accountability.
Coxswain engineer, \$1,560				2	For operation of launches <i>Patrol</i> and <i>Pioneer</i> .
Coxswain engineer, \$1,740				1	For operation of launch <i>Search</i> .
Craneman, \$2,220			7	11	Increase of 3 account establishing three 8-hour shifts on 5-yard dipper dredges; 1 extra position for relief account of sickness and emergency.
Craneman, \$2,040				6	For operation of dredges <i>Gamboa</i> and <i>Paraiso</i> .
Engineer (assistant), \$2,700				1	Account temporary transfer of part of Central Division engineering force to work up notes and close records of dry excavation, central section.
Engineer (junior), \$2,100				2	Same as above.
Engineer, steam, \$1,800			1	2	Increase of 1 for extra locomotive crane during construction of pontoon bridge, and handling repair parts and supplies for marine equipment.
Engineer, steam, \$1,500				1	Account transfer of pile driver No. 1.
Engineer	1,740	1,860			Appointing rate for these positions, \$1,740; increase of 16 provided to permit increase of pay for satisfactory service prior to permanent vessel assignment.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued					
DREDGING DIVISION—contd.					
Engineer.....	\$1,380	\$1,740			Increase of 2 account difficulty in securing properly qualified men for seagoing suction dredges at lower rate.
Engineer.....	1,200	1,620			Same as above.
Engineer.....	1,500	2,100			Increase account placing tug <i>De Lesseps</i> in regular towboat service in Culebra Cut acting as dredge tender, shifting scows, etc.
Engineer.....	1,440	2,040			Same as above
Engineer, \$2,400.....			3	5	For operation of dredges <i>Gamboa</i> and <i>Paraíso</i> .
Engineer, \$2,100.....			4	11	9 in approved organization July 1, 1913; increase 1 account tug <i>Sanidad</i> ; 1 account tug <i>Mariner</i> .
Engineer, \$2,040.....				14	2 in approved organization July 1, 1913; increase 10 account placing tugboats on three-shift basis; 2 account tug <i>Sanidad</i> .
Engineer, \$1,980.....			2	16	15 in approved organization July 1, 1913; increase 1 account replacing <i>Clapet No. 12</i> in service.
Engineer, \$1,860.....			11	55	45 in approved organization July 1, 1913; increase 2 account tug <i>Bolívar</i> ; 6 for operation of dredges <i>Gamboa</i> and <i>Paraíso</i> ; 2 account replacing <i>Clapet No. 12</i> in service.
Engineer, \$1,740.....			12	17	1 in approved organization July 1, 1913; increase of 16 account placing tugboats on three-shift basis.
Erector, \$1,244.....				1	Account temporary transfer of employee rated as erector, 50 cents per hour, for diving work during absence of regular diver in the United States on official legal matters.
Foreman, \$2,100.....				1	Account of establishing widely separated relay pump stations it was found necessary to appoint a foreman for supervision of operating force and general maintenance of pumping units.
Foreman.....	1,680	2,400			Increase to provide for employment of American night foreman of the dredging, Culebra Cut.
Do.....	1,500	1,650			Account of consolidation of dredging fleets in Culebra Cut, responsibility and work of foreman for supervision of barge repairs greatly increased, and it was necessary to increase pay of position in order to obtain the most efficient man for this work.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
DREDGING DIVISION—contd.					
Foreman.....	\$1,500	\$1,650			Account of consolidation of dredging fleets in Culebra Cut, responsibility and work of supervision of foreman of coaling operations greatly increased, and it was necessary to increase pay of position in order to obtain the most efficient man for this work.
Foreman, \$1,800.....				1	account of transfer of pile driver No. 1.
Foreman, \$1,500.....				2	1 account necessity of having a gold employee for supervision of field time keeping in Culebra Cut; 1 as supply foreman account consolidation of dredging fleet and necessity of employing an American to handle supplies for dredging fleet.
Foreman, \$1,200.....				3	2 for supervision of equipment engaged in extermination of water hyacinths; 1 as assistant to supply foreman above.
Levelman, \$1,500.....			4	6	Account of temporary transfer of part of central division engineering force to work up notes and close records of dry excavation, central section.
Master.....	1,620	2,220			Increase account of placing tug <i>De Lesseps</i> in the regular towboat service in Culebra Cut, acting as dredge tender, shifting scows, etc.
Master, \$2,400.....				2	For operation of dredges <i>Paraiso</i> and <i>Gamboa</i> .
Master, \$2,220.....			1	7	5 in approved organization July 1, 1913; increase of 1 account temporary transfer of tug <i>Mariner</i> ; 1 account transfer of tug <i>Sanidad</i> .
Master, \$2,040.....			1	16	15 in approved organization July 1, 1913; increase of 1 account replacing <i>Clapet No. 12</i> in service.
Master, \$1,980.....			9	12	11 in approved organization July 1, 1913; increase of 1 account transfer of tug <i>Bolivar</i> .
Mate.....	1,560	2,100			Increase account of placing tug <i>De Lesseps</i> in regular towboat service in Culebra Cut acting as dredge tender, shifting scows, etc.
Do.....	1,380	1,740			Increase of 2 account difficulty in securing properly qualified men for sea-going suction dredges at lower rate.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
DREDGING DIVISION—contd.					
Mate	\$1,200	\$1,620			Same as above.
Mate, \$2,100.....			3	31	10 in approved organization July 1, 1913; increase of 5 account establishing three shifts on French ladder dredges; 11 on account placing tugboats on three-shift basis; 1 in lieu of master at higher rate; 2 account tug <i>Sanidad</i> ; 2 account tug <i>Mariner</i> .
Mate, \$1,860.....			7	39	17 in approved organization July 1, 1913; increase 1 account tug <i>Bolivar</i> ; 7 account establishing claps on three-shift basis; 2 account replacing claps No. 12 in service; 12 in lieu of 6 mates and 6 masters at higher rates.
Mate, \$1,620.....			3	10	6 in approved organization July 1, 1913; increase 4 account establishing 3 shifts on marine equipment.
Motorman, \$800.....				1	Account temporary operation of motor car No. 3.
Operator, \$2,520.....			2	10	6 in approved organization July 1, 1913; increase 3 account establishing 3 8-hour shifts daily on 5-yard dipper dredges; 1 extra position for relief account of sickness and emergency.
Operator, \$2,340.....				6	For operation of dredges <i>Gamboa</i> and <i>Paraiso</i> .
Operator, \$1,620.....			3	10	Increase 4 to provide for operation of relay pumps at Cucaracha slide; 3 for operation of relay pumps at Balboa and Ancon, necessary in connection with inner-harbor operations and reclamation of land.
Transitman, \$1,800.....				3	Account temporary transfer of part of central division engineering force to work up notes and close records of dry excavation, central section.
MECHANICAL DIVISION. ¹					
Accountant, \$2,100.....				1	Lieu clerk \$1,800 account reorganization accounting system and increased responsibilities.
Accountant, \$2,400.....				1	Lieu clerk, \$2,100, and abolishing assistant chief clerk \$2,400; letter chairman Aug 30, 1913.

¹ After preliminary estimates for 1913-14 had been submitted in August, 1912, the following transfers to the mechanical division were made which were not considered in the estimates: Electrical work of the Pacific division and Miraflores power plant, May 1, 1913; electrical work of the Atlantic division and Gatun power plant, Oct. 15, 1913; Paraiso shops reopened Oct. 6, 1913; dry-dock shops, Cristobal, from Atlantic division, May 1, 1913; shipways shops, Balboa, from dredging division, Oct. 22, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book o. Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Clerk, \$900.....			5	8	3 account reorganizing accounting system; letter executive secretary, June 23, 1914.
Clerk.....	\$1,800	\$2,100	2	4	1 at dry dock in organization of Apr. 1, 1914, account increased work; 1 in reorganization of drafting department and material inspector reduced from \$200 to \$175; chairman's letter Nov. 28, 1913.
Do.....	1,950	2,100			
Draftsman, \$1,800.....			4	5	1 with transfer Paraiso shops from sixth division; letter chairman Oct. 7, 1913.
Draftsman, \$1,850.....				1	1 for electrical installation permanent shops; chairman's letter Dec. 13, 1913.
Draftsman, \$2,100.....			1	3	1 to lay out conduit lines, etc., for new town of Balboa; chairman's letter Mar. 13, 1914; 1 account reorganization of drafting room due to resignation of chief draftsman; chairman's letter Nov. 28, 1913.
Do.....	1,800	2,100			
Foreman, \$1,200.....				1	1 in charge utility gang, permanent shops; chairman's letter Feb. 13, 1914.
Foreman, \$1,500.....			3	7	2 transferred with Gatun power plant; chairman's letter Oct. 15, 1913; 1 transferred with Paraiso shops from sixth division; chairman's letter Oct. 7, 1913; 1 transferred from sixth division with shipways shops; chairman's letter Oct. 8, 1913.
Foreman, \$1,740.....			1	2	1 to take charge night shift, planing mill, Balboa shops; chairman's letter Oct. 17, 1913.
Foreman, \$1,800.....			7	16	1 in lieu car inspector \$1,800 to supervise Mt. Hope-Cristobal car-inspection district; governor's letter June 2, 1914; 1 for installing machines and erection steelwork permanent shops; chairman's letter July 3, 1913; 1 to handle structural-steel work in permanent shops; chairman's letter Aug. 12, 1913; 1 to supervise setting wood block floors permanent shops; Mr. Eason's letter to inspector of shops, Sept. 2, 1913; 1 for Paraiso shops, chairman's letter of Nov. 12, 1913; 1 for electrical installation, permanent shops; chairman's letter Nov. 13, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Foreman.....	\$1,740	\$1,800	7	16	1 increased from \$1,740 to \$1,800, account increased duties due to abolishing position of foreman \$1,800 on passenger-car work and taking over of this work at Cristobal by freight-car foreman; chairman's letter Nov. 13, 1913; 2; see last year's report.
Foreman, \$1,920.....			4	12	6 covered by organization of Apr. 1, 1914; 1 for second shift on dredge Caribbean; chairman's letter Dec. 26, 1913; 1 to take charge of hostling at Empire, due to resumption of excavation at Rio Grande; governor's letter Apr. 6, 1914.
Foreman, \$1,980.....			1	2	1 to handle night shift at dry-dock shops; chairman's letter Aug. 14, 1913.
Foreman, \$2,100.....			10	24	1 to enable three shifts to work on dredge No. 4; chairman's letter Aug. 29, 1913; 1 to handle night shift on dredge 86 to complete by Oct. 6, 1913; chairman's letter Sept. 20, 1913; 1 at dry-dock shops, lieu 1 at \$1,980 abolished; chairman's letter Oct. 6, 1913; 2 with the Paraiso shops from sixth division; chairman's letter, Oct. 7, 1913; 1 title of material inspector changed to shop work order foreman and salary reduced to \$2,100 from \$2,400; chairman's letter Nov. 28, 1913; 1 for night shift on dredges Sandpiper and No. 1; chairman's letter Nov. 26, 1913; 1 for Balboa shops; chairman's letter Nov. 20, 1913; 1 transferred from sixth division with shipways shops; chairman's letter Oct. 8, 1913; 1 account large amount of shipwright work on hand at Paraiso shops; letter of executive secretary May 20, 1914; 1 for outside boiler work; governor's letter May 15, 1914; 1 transferred from sixth division to place foreman in charge of night shift of blacksmith's, Empire shops; chairman's letter Oct. 18, 1913; 1 to handle pipe work at Miraflores and Pedro Miguel; chairman's letter Oct. 30, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—(continued.					
MECHANICAL DIVISION—contd.					
Foreman.....	\$1,950	\$2,100	10	.....	Increased due to taking over by erection shop foreman, Empire shops, preparation equipment for storage; 1 machinist 70 cents abolished; chairman's letter Nov. 18, 1913.
Foreman, \$2,160.....				1	Reorganization of Apr. 1, 1914; approved in Apr. 1, 1914, organization.
Foreman, \$2,280.....				1	See last year's report.
Foreman, \$2,400.....			8	13	1 to handle preparation of equipment for storage; chairman's letter Sept. 29, 1914; 1 transferred with Gatun power plant and electrical work from Atlantic division Oct. 15, 1913; chairman's letter Nov. 10, 1913; 1 to install electrical equipment in permanent shops; chairman's letter Dec. 13, 1913.
Foreman.....	2,100	2,400			1 increased, account responsibilities, Balboa dump engine house; chairman's letter of Aug. 28, 1913; 1 increased, account increased responsibilities due to reorganization of shop order section; chairman's letter July 17, 1913.
Do.....	2,700	2,880			1 increased in reorganization Apr. 1, 1914; approved in organization; submitted Apr. 1, 1914, in charge night shift permanent shops.
Do.....	2,700	3,000			1 increased in reorganization Apr. 1, 1914; increased responsibilities in charge car department; letter executive secretary June 23, 1914.
Foreman, \$3,300.....				2	1 to take charge of permanent shops; chairman's letter Oct. 11, 1913.
Foreman.....	3,000	3,300			1 increased account closing Gorgona shops and transfer of work to Empire; chairman's letter July 17, 1913.
Inspector.....	2,100	2,400			1 increased in reorganization on transfer of work from Gorgona to Empire; chairman's letter July 11, 1913.
Inspector, \$1,800.....			1	4	1 scale inspector lieu machinist at 65 cents on account excess travel time; chairman's letter of June 5, 1913; 1 to inspect permanent shop buildings; chairman's letter Nov. 23, 1913; 1; see last year's report.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Superintendent of dredging, \$2,100.				1	With transfer Paraiso shops from sixth division; chairman's letter Oct. 7, 1913.
Superintendent of erection, \$3,900.				1	In charge permanent shops; chairman's letter of July 19, 1913.
Assistant superintendent, \$4,800.				1	Account abolishing position of superintendent at \$5,400; chairman's letter July 17, 1913.
Superintendent, \$6,000.				1	Placed in charge of mechanical division; chairman's circular 523 of Jan. 26, 1914.
Engineer, traveling, \$3,000.				1	Transferred to mechanical division in reorganization Apr. 1, 1914.
Angle smith and flange turner, \$1,741.60.				2	Approved in organization Apr. 1, 1914.
Apprentice \$622.				3	Completed third year of apprenticeship.
Blacksmith, \$1,617.20.			22	33	8; see last year's report. 3 transferred with Paraiso shops from sixth division; chairman's letter, Oct. 7, 1913.
Boiler maker, \$1,617.20.			33	60	10 in lieu 10 machinists, 65 cents, account increased structural work on permanent shops and floating equipment; chairman's letter Aug. 30, 1913; 9 from 6th division with the Paraiso shops; chairman's letter, Oct. 7, 1913; 8; see last year's report.
Boiler maker, \$1,741.60.			4	6	1 account transfer shipways shops from sixth division; chairman's letter, Oct. 8, 1913; 1 to take charge second shift at Paraiso; chairman's letter Dec. 23, 1913.
Carpenter, \$1,393.28.			6	26	20 account increased work account permanent buildings; chairman's letter, Jan. 8, 1914.
Carpenter, \$1,617.20.			1	6	5 transferred with Paraiso shops from sixth division; chairman's letter Oct. 7, 1913.
Cable splicer, \$1,617.20.				2	Account electrical installation in permanent shops; chairman's letter, Dec. 13, 1913.
Checker, shop, \$1,200.			5	10	2 account moving shops from Gorgona to Empire; chairman's letter, July 17, 1913, and Col. Dickson's letter, July 22, 1913; 1 for Paraiso shops; chairman's letter of Jan. 27, 1914; 1; see last year's report; 1 temporarily account man on vacation; chairman's letter, May 19, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Checker, shop, \$1,500.....			2	8	1 for permanent shops, checking material, etc.; chairman's letter, Sept. 10, 1913; 1 for electrical installation permanent shops; chairman's letter, Dec. 13, 1913; 4; see last year's report.
Engineer, steam, \$1,650.....				2	1 transferred with Gatun power plant from Atlantic division, Oct. 15, 1913; chairman's letter, Nov. 10, 1913; 1; see last year's report.
Engineer, steam, \$1,800.....			5	8	2 transferred with Paraiso shops from sixth division; chairman's letter, Oct. 7, 1913; 1; see last year's report.
Engineer, steam, \$2,100.....			5	7	2 with transfer of Gatun power plant from Atlantic division, Oct. 15, 1913; chairman's letter, Nov. 10, 1913.
Engineer, steam, \$2,400.....				2	1 transferred with Gatun power plant from Atlantic division, Oct. 15, 1913; chairman's letter, Nov. 10, 1913; 1; see last year's report.
Engineer, station.....	\$2,700	\$3,000			1 increased to \$3,000 at Miraflores power plant account reorganization abolishing one district; chairman's letter, Nov. 7, 1913.
Inspector, car, \$1,800.....				10	1 account reorganization car-inspection service due to taking over P. R. R. work; chairman's letter, Nov. 11, 1913; 4 authorized in organization approved Apr. 1, 1914; 5; see last year's report.
Ironworker, \$1,617.20.....				12	8 with transfer shipways shops from sixth division; chairman's letter, Dec. 3, 1913; 4; see last year's report.
Lineman, \$1,617.20.....			7	13	1 account construction various pole lines; chairman's letter July 17, 1913; 1 in lieu of 1 at \$1,800 account irregular hours no longer required; chairman's letter, July 21, 1913; 1 in order to complete line work by Oct. 1, 1913; chairman's letter, Aug. 5, 1913; 1 in lieu of 1 at \$1,650 at Gatun power plant; chairman's letter, Oct. 22, 1913; 2 transferred with Gatun power plant and electrical work from Atlantic division, Oct. 15, 1913; letter of chairman, Nov. 10, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Lineman, \$1,650.....				2	2 transferred with Gatun power plant and electrical work from Atlantic division, Oct. 15, 1913; chairman's letter, Nov. 10, 1913.
Machinist, \$1,617.20.....			185	280	16 with transfer Paraiso shops from sixth division, Oct. 6, 1913; chairman's letter, Oct. 7, 1913; 1 in lieu of 1 at \$1,650. Gatun power plant, Nov. 1, 1913; chairman's letter, Oct. 22, 1913; 78; see last year's report.
Machinist, \$1,741.60.....				2	1 with transfer shipways shops from sixth division, Oct. 15, 1913; chairman's letter, Oct. 18, 1913; 1; see last year's report.
Operator, crane, \$1,094.72.....				4	4 reorganization due to closing Gorgona shops and transfer of work to Empire; effective Aug. 1, 1913; chairman's letter July 17, 1913.
Operator, crane, \$1,200.....				8	4 to operate overhead cranes in permanent shops; effective Dec. 22, 1913; chairman's letter Dec. 20, 1913; 4 account transfer cranes on Balboa Docks from quartermaster department, July 16, 1913; chairman's letter July 31, 1913.
Operator, pump, \$1,500.....				3	3 transferred with Gatun power plant and electric work Oct. 15, 1913, from Atlantic division; chairman's letter Nov. 10, 1913.
Operator, pump, \$1,620.....				9	3, same as item next above; 3 to handle drainage pumps in dry-dock excavation, Balboa, chairman's letter, July 16, 1913; 3, see last year's report.
Operator, substation, \$1,200.....				3	3 to operate Balboa substation, Jan. 1, 1914; chairman's letter Dec. 29, 1913.
Operator, substation, \$1,500.....				1	1 Balboa substation account operating third shift in planing mill permanent shops; effective Jan. 26, 1914; chairman's letter Jan. 3, 1914.
Operator, substation, \$1,650.....				2	1 Balboa substation account night shift permanent shops; effective Nov. 1, 1913; chairman's letter Oct. 29, 1913; 1, see last year's report.
Operator, switchboard, \$1,800.....				6	3 transferred with Gatun power house Oct. 15, 1913; chairman's letter Nov. 10, 1913; 3, see last year's report.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Cont nued.					
MECHANICAL DIVISION—contd.					
Pipefitter, \$1,617.20.....			9	39	4 with transfer shipways shops from sixth division Nov. 1, 1913; chairman's letter Dec. 3, 1913; 2 account increase pipe work; chief clerk's, chairman's office, letter Jan. 19, 1914; 10 in organization approved Apr. 1, 1914; 14, see last year's report.
Planing-mill hand, \$1,393.28....			12	30	8 account increased work in planing mill, Balboa, Jan. 19, 1914; chairman's letter Jan. 29, 1914; 10 in organization approved Apr. 1, 1914, account large amount of millwork for permanent buildings.
Planing-mill hand, \$1,617.20....			1	2	1 to take charge third shift in planing mill, Balboa, effective Dec. 22, 1913; chairman's letter Dec. 20, 1913.
Plumber, \$1,866.....				6	3 effective Oct. 13, 1913, for 3 months for plumbing work in permanent shops; chairman's letter Oct. 25, 1913; 6 continuation of above and increase of 3 for plumbing work in permanent shops; effective Jan. 24, 1914; chairman's letter Jan. 28, 1914.
Recorder, station, \$1,800.....				1	1 transferred with Gatun power plant, Atlantic division, Oct. 15, 1913; chairman's letter Nov. 10, 1913.
Ship fitter, \$1,617.20.....				30	3 effective Nov. 1, 1913, with transfer shipways shops from sixth division; chairman's letter of Dec. 3, 1913; 10 in lieu of 10 machinists, same rate, account increase in ship work; effective Dec. 1, 1913; chairman's letter Jan. 29, 1914; 14 in organization approved Apr. 1, 1914; 3, see last year's report.
Shipwright, \$1,617.20.....				25	8 effective Nov. 1, 1913, transferred with shipways shops from sixth division; chairman's letter Dec. 3, 1913; 12 effective May 14, 1914, account large amount of work on floating equipment; chairman's letter May 20, 1914; 5, see last year's report.
Typewriter repairer, \$1,620....				2	2 effective Sept. 1, 1913, in lieu of 2 at \$1,500 abolished; chairman's letter Sept. 4, 1913.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF OPERATION AND MAINTENANCE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF TERMINAL CONSTRUCTION—Continued.					
MECHANICAL DIVISION—contd.					
Wireman, \$1,244.....				5	5 effective Dec. 15, 1913, for electric installation permanent shops; chairman's letter Dec. 13, 1913.
Wireman, \$1,393.28.....			3	13	10, same as item next above.
Wireman, \$1,617.20.....			18	75	7, 4 in lieu of 4 at \$1,950 and 3 in lieu of 3 at \$1,800, account of irregular hours no longer required; chairman's letter July 21, 1913; 2, 1 in lieu of 1 at \$1,950 and 1 in lieu of 1 at \$1,800, account irregular hours no longer required; chairman's letter Oct. 22, 1913; 35, account electric installation permanent shops; effective Dec. 15, 1913; chairman's letter Dec. 13, 1913; 6 to handle repairs for electric equipment in permanent shops; letter executive secretary May 13, 1914; 7, see last year's report.
Wireman, \$1,800.....				4	1 transferred with Gatun power plant and electric work from Atlantic division Oct. 15, 1913; chairman's letter Nov. 10, 1913; 3, see last year's report.
Wireman, \$1,950.....				7	1 transferred with the Gatun power plant and electric work from Atlantic division Oct. 15, 1913; chairman's letter Nov. 10, 1913; 6, see last year's report.

SUPPLY DEPARTMENT.

[Including quartermaster's department and subsistence department.]

Foreman.....	\$2,100	\$2,400			Work requiring special knowledge; in charge scrap yard and obsolete equipment.
Inspector, special, \$4,500.....				1	Due to consolidation quartermaster's and subsistence departments into supply department; subsistence officer at \$7,500 and assistant subsistence officer at \$4,000 no longer carried.
Depot commissary, \$4,800.....				1	
Resident engineer, \$7,200.....				1	Permanent buildings.
Assistant resident engineer, \$3,300.....				1	Do.
General superintendent, \$3,960.....				1	Do.
General superintendent, \$3,600.....				1	Do.
Architect, \$3,000.....				1	Do.
Assistant engineer, \$2,700.....				1	Do.
					NOTE.—Architect at \$7,500 and constructing quartermaster at \$4,000 no longer carried.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

SUPPLY DEPARTMENT—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
Inspector, \$2,100.....				1	Permanent buildings.
Levelman, \$1,500.....				2	Do.
Superintendent, \$2,700.....				1	Do.
Superintendent, \$2,400.....				1	Do.
Transitman, \$1,800.....				3	Do.
Clerk, general property, \$2,100.....				1	Do.
Clerk, \$1,650.....				2	Do.
Engineer, H. steam, \$1,500.....				1	Do.
Engineer, junior, \$2,100.....				3	Do.
Foreman, carpenter, \$2,100.....				9	Do.
Foreman, carpenter, \$1,980.....				5	Do.
Foreman, carpenter, \$1,800.....				22	Do.
Foreman, carpenter, \$1,650.....				4	Do.
Foreman, carpenter, \$1,500.....				5	Do.
Foreman, carpenter, \$1,468.....				5	Do.
Foreman, carpenter, \$1,326.....				39	Do.
Foreman, carpenter, \$1,142.....				66	Do.
Foreman, carpenter, \$1,020.....				1	Do.
Foreman, carpenter, \$897.....				1	Do.
Foreman, carpenter, \$652.....				2	Do.
Foreman, concrete, \$2,100.....				4	Do.
Foreman, concrete, \$1,980.....				1	Do.
Foreman, concrete, \$1,800.....				1	Do.
Foreman, general, \$2,700.....				1	Do.
Foreman, general, \$2,400.....				1	Do.
Foreman, general, \$2,100.....				1	Do.
Foreman, general, \$1,980.....				1	Do.
Foreman, general, \$1,800.....				17	Do.
Foreman, general, \$1,650.....				3	Do.
Foreman, general, \$1,500.....				13	Do.
Foreman, general, \$1,200.....				6	Do.
Foreman, general, \$900.....				1	Do.
Foreman, ironworker, \$897.....				1	Do.
Foreman, lather, \$3,000.....				1	Do.
Foreman, mason, \$2,700.....				1	Do.
Foreman, mason, \$2,100.....				2	Do.
Foreman, mason, \$1,800.....				7	Do.
Foreman, mason, \$1,530.....				5	Do.
Foreman, mason, \$1,428.....				31	Do.
Foreman, mason, \$1,326.....				1	Do.
Foreman, mason, \$1,020.....				2	Do.
Foreman, metal lather, \$1,800.....				6	Do.
Foreman, metal lather, \$1,650.....				1	Do.
Foreman, metal lather, \$1,428.....				3	Do.
Foreman, metal lather, \$1,020.....				1	Do.
Foreman, metal lather, \$897.....				1	Do.
Foreman, painter, \$1,980.....				2	Do.
Foreman, painter, \$1,800.....				2	Do.
Foreman, painter, \$1,500.....				2	Do.
Foreman, painter, \$1,326.....				1	Do.
Foreman, painter, \$1,142.....				9	Do.
Foreman, painter, \$775.....				3	Do.
Foreman, painter, \$652.....				2	Do.
Foreman, plasterer, \$3,000.....				1	Do.
Foreman, plasterer, \$1,530.....				8	Do.
Foreman, plasterer, \$1,428.....				218	Do.
Foreman, plumbing, \$2,400.....				1	Do.
Foreman, plumbing, \$1,693.....				2	Do.
Foreman, plumbing, \$1,530.....				20	Do.
Foreman, plumbing, \$1,754.....				1	Do.
Foreman, plumbing, \$1,428.....				59	Do.
Foreman, plumbing, \$1,142.....				2	Do.
Foreman, sheet metal, \$2,100.....				1	Do.
Foreman, sheet metal, \$1,800.....				12	Do.
Foreman, sheet metal, \$1,650.....				1	Do.
Foreman, sheet metal, \$1,428.....				8	Do.
Foreman, sheet metal, \$1,142.....				1	Do.
Foreman, tile setting, \$2,400.....				1	Do.
Foreman, tile setting, \$1,800.....				8	Do.
Foreman, tile setting, \$1,428.....				8	Do.
Foreman, tile setting, \$1,326.....				1	Do.
Foreman, tile setting, \$1,142.....				1	Do.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

ACCOUNTING DEPARTMENT.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
Expert accountant, \$6,000 plus per diem of \$5.				1	Employed Oct. 10, 1913, to assist in formulating a permanent accounting system for the Panama Canal. Services terminated April, 1914.
Accountant, \$2,400.				1	Employed Oct. 9, 1913, on special work in connection with the permanent accounting system.
Commissary accountant, \$2,400.				1	Authorized Feb. 11, 1914, to take charge of commissary-subsistence department accounting work, which was formally transferred to accounting department Apr. 1, 1914. Salary billed against commissary department.
Clerk, \$2,400.			4	5	Additional clerk in charge of material and property accounting work transferred from quartermaster's department during January, 1914.
Clerk, \$2,100.			9	12	3 additional transferred from quartermaster's department with material and property accounting work during January, 1914.
Clerk, \$1,800.			15	18	2 transferred from quartermaster's department with material and property accounting work during January, 1914; 1 additional authorized Mar. 6, 1914, account increase in material and property accounting work.
Clerk, \$1,650.			10	13	3 continued from 1913, as no reduction in work took place.
Clerk, \$1,500.			10	14	1 continued from 1913, account no reduction in work; 3 transferred with their work from quartermaster's department in January, 1914.
Clerk, \$900.			5	6	Additional place authorized account transfer of material and property accounting work, Jan. 1, 1914.
Clerk, \$840.				1	Transferred with work from commissary-subsistence department, Mar. 11, 1914. Salary billed against that department.
Time inspector, \$2,100.				2	Authorized Jan. 1, 1914, in lieu of 3 at \$1,950, with consolidation of 3 time inspection districts into 2.
Time inspector, \$1,500.			10	15	5 continued from 1913, account no reduction in work until October, 1913, when the total number was reduced to 12.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

DEPARTMENT OF HEALTH.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
Chief health office: Storekeeper.....	\$2,100	\$2,400			Increased July 1, 1913, as per chairman's letter of Aug. 2, 1913, account responsibility of position and the improvements made in the storehouse during his 4 years' incumbency.
Ancon Hospital: Operator (crematory), \$1,800.				1	Position authorized Oct. 2, 1913, filled Feb. 7, 1914, to June 30, 1914. Required on account installing crematory and removal of Ancon cemetery; effective July 1, 1914, this position was combined with that of embalmer and rated as embalmer and cremator at \$1,800.
Steward, \$1,500.....				1	Employed June 1, 1914, as per authority in governor's letter of May 22, 1914. Placed in charge of all messes in the hospital. Replaces man on silver roll—salary of the head cook reduced.
Laboratory assistant, \$1,260.....		4	1	4	Effective June 1, 3 male nurses' designations changed to laboratory assistant—Executive secretary's letter of May 14, 1914.
Health office, Colon: Assistant health officer, \$3,000				1	This position was temporarily filled from Apr. 1 to 24 incident to the new organization, which went into effect Apr. 1.
Health office, Panama: Health officer, \$4,000.....				1	With the relief of Dr. Perry who filled the position of health officer in addition to his duties as chief quarantine officer, it was necessary to appoint a health officer; authority, governor's letter, May 14, 1914.

EXECUTIVE DEPARTMENT.

[Including the department of civil administration, which was abolished on Mar. 31, 1914.]

DIVISION OF SCHOOLS.					
Teacher, high school, \$1,125....				1	Effective Oct. 3, 1912, to increase pay of teacher acting as principal of consolidated high and grammar school at Gatun. (See annual report for fiscal year 1913.)
Teacher, high school.....	\$990	\$1,125			Effective Oct. 1, 1913. Teacher of science. Position filled by man. Impossible to retain competent man at \$990.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

EXECUTIVE DEPARTMENT—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF SCHOOLS—contd.					
Supervisor, primary grades....	\$1,575	\$1,750	.....	.....	Effective Sept. 20, 1913. Length of service year increased from 9 to 10 months, at \$175 per month: Necessary to enable supervisor to grade pupils, arrange classes, etc., before opening of school year and to close up work at end of year.
Brake supervisor (or attendant), \$270.	.....	.....	.....	2	Work formerly performed by brake teachers. Change made to increase efficiency of teachers. Two positions as brake teacher and one position as children's attendant abolished. One position effective Nov. 6, 1913, and 1 Nov. 17, 1913. Two teachers, at \$810, in place of 2 brake teachers at \$990.
Teacher, high school, Spanish.	270	810	.....	.....	Effective Oct. 22, 1913. Position at \$270 authorized Aug. 13, 1912, providing for 1½ hours of teaching for 3 days a week. (See 1913 annual report.) Teacher now required to teach French and Spanish 5 days a week and length of service day increased to regular school day of 4 hours and 40 minutes.
Supervisor of upper grades, \$2,000.	.....	.....	1	2	Temporary appointment pending arrival of regularly appointed supervisor from States. Temporary supervisor employed from Nov. 6 to Nov. 27, 1913.
Teacher, high school, \$900.....	.....	.....	.....	4	Oct. 22, 1913, 2 new positions at \$900 created and 1 position of teacher at \$810 abolished. Nov. 18, 1913, 2 new positions at \$900 created and 1 position of high-school teacher at \$990 and 1 position of teacher at \$810 abolished. Actual increase in force, 1.
Principal, high school.....	1,350	1,575	.....	.....	Authorized Aug. 13, 1912, on account of increased work. Offset by decrease of 1 teacher at \$810. (See p. 83, Book of Estimates, 1914.)
Teacher, \$810.....	.....	.....	25	30	Number of teachers at \$810 for 1914 was estimated at 25, based on estimated reductions in canal force. No actual increases in number, but reductions in force were less than anticipated.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

EXECUTIVE DEPARTMENT—Continued..

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
DIVISION OF CIVIL AFFAIRS.					
Division of revenues:					
Senior clerk, \$2,100.....				1	
Deputy collector, \$2,100 (second).				1	Abolition of 3 clerkships at \$1,950, \$1,800, and \$1,500, respectively, and the creation of the positions of second deputy collector at \$2,100 and senior clerk at \$2,100.
Inspector, \$1,800.....				1	Abolition of 1 clerkship at \$1,800 and creation of a position as inspector.
Clerk, \$1,500.....			2	3	Temporary increase of 1 clerk at \$1,500 for 54 days pending the expiration of former incumbent's leave. Abolition of 2 clerkships at \$900 and \$600, respectively, and the creation of 1 clerkship at \$1,500.
Inspector, \$1,500.....			1	2	Temporary increase of 1 inspector of customs at \$1,500 for 94 days pending the expiration of former incumbent's accrued leave.
Division of posts: Postmaster, \$2,600.			1	2	Temporary increase of 1 postmaster at \$2,600 for 65 days pending expiration of former incumbent's leave.
Postmaster, \$300.....			2	3	Abolition of position at \$900 and increase by 1 at \$300, effective Aug. 1, 1913.
Postmaster, \$180.....				1	Station agent, P. R. R., at Gamboa, authorized to act as postmaster for sale of stamps and delivery of mail, effective Mar. 13, 1914.
Postmaster, assistant, \$1,800...			1	2	Increase in salary of assistant postmaster at Ancon from \$1,550, to \$1,800, effective Feb. 12, 1914.
Chief dispatching clerk, \$1,650.				1	Abolition of 2 positions as postal clerk at \$1,500 and creation of position as chief dispatching clerk.
Postal clerk, \$1,200.....				1	Temporary increase by 1 clerk at \$1,200 for 42 days, effective July 14, 1913.
Clerk, \$900.....			4	5	Temporary increase by 1 clerk for 95 days commencing July 14, 1913.

NOTE.—Previous changes reported in annual report for the fiscal year 1913.

OFFICE OF SPECIAL ATTORNEY.

Inspector.....	\$1,800.00	\$2,100.00			1 inspector raised from \$1,800 to \$2,100, account increase in amount and efficiency of his work.
Inspector, \$2,400.....				1	Additional inspector at \$2,400, necessary on account of increased work due to reorganization of Joint Land Commission.

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

WASHINGTON OFFICE.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
Purchasing: Clerk, New Orleans.....	\$1,500.00	\$1,800.00	.....	.....	Increased on account of increased duties and responsibilities. On account of the increase of the Army duties of the United States Army officer detailed to act as assistant purchasing agent at New Orleans, the clerk handles all details of purchases made for the Panama Canal through the New Orleans office. He also acts as assistant purchasing agent in the absence of the United States Army officer. Approved by the chairman May 10, 1913.
Administration: Assistant to the chief of office.	2,500.00	3,000.00	.....	.....	Increased on account of the increase in duties and responsibilities due to the large number of important questions arising in connection with the completion, opening, and operation of the canal. Approved by the governor Apr. 6, 1914.
Temporary clerks for all offices.	2,000.00	4,980.30	.....	.....	Excess of \$2,980.30, due to increased work throughout the whole office. Approved by the chairman Nov. 15, 1913.
Accounting: Assistant auditor, \$4,000....	.....	.....	.....	1	In accordance with the Executive order of Mar. 2, 1914, reorganizing the Washington office, the positions of disbursing officer at \$5,000 and assistant examiner of accounts at \$3,600 were abolished, and the positions of assistant auditor and disbursing clerk created, effective Apr. 1, 1914, resulting in a saving in these two positions of \$1,600. The disbursing officer was carried on the rolls during the month of April for special duty in connection with closing up his accounts as disbursing officer of the Isthmian Canal Commission. Approved by the chairman March, 1914.
Disbursing clerk, \$3,000....	.....	.....	.....	1	
Clerk.....	1,600	1,800	.....	.....	Increased on account of increased duties and responsibilities arising from the reorganization of the accounting department on Apr. 1. Approved by the chairman March, 1914.
Do.....	1,400	1,600	.....	.....	

Tables showing increases in salaries authorized over organization of July 1, 1912, and increases of numbers of persons employed over number allowed in 1914 Book of Estimates, as required by act of Congress approved June 23, 1913—Continued.

WASHINGTON OFFICE—Continued.

	Increase in pay.		Increase in numbers.		Explanation.
	Rate authorized in organization July 1, 1912.	Increased to—	Number authorized in 1914 Book of Estimates.	Increased to—	
Inspection of chain fenders:					The men employed in these positions were transferred from the lock-gate inspection to the chain-fender work at the same salaries they were receiving on the lock-gate work, \$3,600 and \$1,500, respectively, and were not reduced to the amounts authorized under the chain-fender organization, in view of the fact that they were also engaged in inspection work under other contracts, including completing inspection on lock and dock gates. Approved by the acting chairman June 21, 1913.
Assistant engineer.....	\$3,000.00	\$3,600.00	.....	.....	
Clerk.....	1,200.00	1,500.00	.....	.....	
Inspection of emergency dams:					It was expected that the inspection work in the United States on the emergency dams would be completed before July 1, 1913, and no estimate was made for this work. On account, however, of additional material being ordered, a small force was required after that date, 1 man only, the inspector at \$1,500, being continued for more than 2 months after July 1, he being employed until Jan. 15, 1914, in checking up and preparing the patterns for shipment to the Isthmus. Approved by the chairman July 12, 1913.
Inspector in charge, \$3,000.....	.....	.....	.....	1	
Clerk, \$1,000.....	.....	.....	.....	1	
Inspector, \$1,800.....	.....	.....	.....	1	
Inspector, \$1,500.....	.....	.....	.....	1	
Inspection of caissons:					These 3 additional inspectors were employed from 4 to 6 months in order to handle properly the inspection of the caissons, which required a larger force than originally estimated. Approved by the chairman Oct. 16, 1913.
Inspector, \$2,400.....	.....	.....	.....	1	
Inspector, \$1,800.....	.....	.....	.....	1	
Inspector, \$1,500.....	.....	.....	.....	1	
Inspection on floating cranes in Germany:					Contract for the floating cranes had not been let at the time the 1914 estimates were prepared, and therefore details of inspection force could not be definitely foreseen. Approved by the chairman Aug. 14, 1913.
Assistant engineer, \$3,300.....	.....	.....	.....	1	
Inspector, \$2,400.....	.....	.....	.....	1	
Inspector, \$990.....	.....	.....	.....	1	
Inspector, \$720.....	.....	.....	.....	1	

APPENDIX L.

ACTS OF CONGRESS AFFECTING THE PANAMA CANAL AND EXECUTIVE ORDERS RELATING TO THE CANAL ZONE.

INDEX.

Acts of Congress:	Page.
Making appropriations to supply urgent deficiencies in appropriations for the fiscal year 1913, and for other purposes, approved October 22, 1913..	555
Amending an Act entitled "An Act to prohibit the importation and use of opium for other than medicinal purposes," approved February 9, 1909; approved January 17, 1914.....	555
Authorizing the President of the United States to locate, construct, and operate railroads in the Territory of Alaska, and for other purposes, approved, March 12, 1914.....	556
Making appropriations to supply urgent deficiencies in appropriations for the fiscal year 1914 and for prior years, and for other purposes, approved, April 6, 1914.....	556
Amending section five of "An Act to provide for the opening, maintenance, protection, and operation of The Panama Canal and the sanitation and government of the Canal Zone," approved August twenty-fourth, 1912; approved June 15, 1914.....	557
Authorizing and directing Colonel George W. Goethals, Governor of the Canal Zone, and formerly chairman and chief engineer of the Isthmian Canal Commission, to investigate certain claims of the McClintic-Marshall Construction Company, approved, June 24, 1914.....	558
Making appropriations for the Diplomatic and Consular Service for the fiscal year ending June 30, 1915, approved, June 30, 1914.....	558
Joint Resolution Extending appropriations for the necessary operations of the Government and of the District of Columbia under certain contingencies, approved, June 30, 1914.....	559
Making appropriations for the naval service for the fiscal year ending June 30, 1915, and for other purposes, approved, June 30, 1914.....	559
Executive orders:	
Prohibiting the unauthorized use of flying machines, August 7, 1913.....	560
Appointing Richard Lee Metcalfe a member of the Isthmian Canal Commission, August 9, 1913.....	560
Relating to bail bonds and money deposits in lieu thereof, and to amend section 310 of Criminal Procedure of the Canal Zone, August 29, 1913..	561
Retaining Lieutenant-Colonel D. DuB. Gaillard, Corps of Engineers, U. S. A., as Member of the Isthmian Canal Commission, and granting leave of absence with full pay, September 20, 1913.....	561
Punishing deported persons who return to the Canal Zone, September 25, 1913.....	561
Regulating the carrying of arms, November 7, 1913.....	562
Fixing the rate of interest on money, November 11, 1913.....	563
Proclamation by the President of the United States of America, establishing rules for the measurement of vessels for the Panama Canal, November 21, 1913.....	564
Fixing total compensation of Professor Emory R. Johnson, Special Commissioner, January 20, 1914.....	581
Preventing the corrupt influencing of Agents, Employees or Servants, January 21, 1914.....	581
Preventing fire-hunting at night, and hunting by means of a spring or trap, and to repeal the Executive Order of September 8, 1909, January 27, 1914.	581
Establishing a permanent organization for The Panama Canal, January 27, 1914.....	582

Executive orders—Continued.

	Page.
Providing conditions of employment for the Permanent Force for The Panama Canal, February 2, 1914.....	584
Establishing a Washington Office of The Panama Canal, to provide temporarily for the Organization, Officials and Employees thereof, and to continue in force for The Panama Canal Rules, Regulations, and Executive Orders which may have been made for the Isthmian Canal Commission, March 2, 1914.....	587
Relating to the Canal Zone Judiciary, March 12, 1914.....	589
Providing a method for the determination and adjustment of all claims arising out of personal injuries to employees while engaged in construction, maintenance, operation or sanitation of the Canal, or of the Panama Railroad, March 20, 1914.....	590
Establishing regulations relative to the payment of tolls and of bills for materials, supplies, repairs, harbor pilotage, towage, and other services, furnished to vessels by The Panama Canal, April 16, 1914.....	597
Fixing salaries of Levi Monroe Kagy and David Marks, members of the Joint Land Commission, May 8, 1914.....	599
Approving all acts and resolutions of the Isthmian Canal Commission, passed since February 28, 1907, relative to the Government of the Canal Zone prior to March 4, 1905, May 13, 1914.....	599
Relating to Pardons, the Remission of Fines and Forfeitures and other subjects, May 13, 1914.....	599
Creating a Committee to formally and officially open The Panama Canal May 20, 1914.....	600
Setting apart land, in the Canal Zone, for the uses and purposes of a radio station and other naval purposes, May 26, 1914.....	600
Amending the Civil Service rules relating to transfers, June 15, 1914.....	601

APPENDIX L.

ACTS OF CONGRESS AFFECTING THE PANAMA CANAL AND EXECUTIVE ORDERS RELATING TO THE CANAL ZONE.

AN ACT Making appropriations to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and thirteen, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and thirteen, and for other purposes, namely:

* * * * *

TREASURY DEPARTMENT.

OFFICE OF AUDITOR FOR WAR DEPARTMENT.

The money accounts of the Panama Canal, under the Panama Canal Act of August twenty-fourth, nineteen hundred and twelve (Statutes at Large, volume thirty-seven, page five hundred and sixty), shall continue to be audited by the Auditor for the War Department.

* * * * *

Approved, October 22, 1913.

AN ACT To amend an Act entitled "An Act to prohibit the importation and use of opium for other than medicinal purposes," approved February ninth, nineteen hundred and nine.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That an Act entitled "An Act to prohibit the importation and use of opium for other than medicinal purposes," approved February ninth, nineteen hundred and nine, is hereby amended so as to read as follows:

* * * * *

"SEC. 5. That no smoking opium or opium prepared for smoking shall be admitted into the United States, or into any territory under the control or jurisdiction thereof, for transportation to another country, nor shall such opium be transferred or transshipped from one vessel to another vessel within any waters of the United States for immediate exportation or any other purpose.

"SEC. 6. That hereafter it shall be unlawful for any person subject to the jurisdiction of the United States to export or cause to be exported from the United States, or from territory under its control or jurisdiction, or from countries in which the United States exercises extraterritorial jurisdiction, any opium or cocaine, or any salt, derivative, or preparation of opium or cocaine, to any other country: *Provided,* That opium or cocaine, and salts, derivatives, or preparations thereof, except smoking opium or opium prepared for smoking, the exportation of which is hereby absolutely prohibited, may be exported to countries regulating their entry under such regulations as are prescribed by such country for the importation thereof into such country, such regulations to be promulgated from time to time by the Secretary of State of the United States.

"The Secretary of State shall request all foreign Governments to communicate through the diplomatic channels copies of laws and regulations promulgated in their respective countries which prohibit or regulate the importation of the aforesaid drugs, and when received advise the Secretary of the Treasury and the Secretary of Commerce thereof; whereupon the Secretary of State, the Secretary of the Treasury, and the Secretary of Commerce shall make and publish all proper regulations for carrying the provisions of this section into effect.

“SEC. 7. That any person who exports or causes to be exported any of the aforesaid drugs in violation of the preceding section shall be fined in any sum not exceeding \$5,000 nor less than \$50 or by imprisonment for any time not exceeding two years, or both. And one-half of any fine recovered from any person or persons convicted of an offense under any section of this act may be paid to the person or persons giving information leading to such recovery, and one-half of any bail forfeited and collected in any proceedings brought under this Act may be paid to the person or persons giving the information which led to the institution of such proceedings, if so directed by the court exercising jurisdiction in the case: *Provided*, That no payment for giving information shall be made to any officer or employee of the United States.

* * * * *

Approved, January 17, 1914.

AN ACT To authorize the President of the United States to locate, construct, and operate railroads in the Territory of Alaska, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States is hereby empowered, authorized and directed * * *

* * * * *

to utilize in carrying on the work herein provided for any and all machinery, equipment, instruments, material, and other property of any sort whatsoever used or acquired in connection with the construction of the Panama Canal, so far and as rapidly as the same is no longer needed at Panama, and the Isthmian Canal Commission is hereby authorized to deliver said property to such officers or persons as the President may designate, and to take credit therefor at such percentage of its original cost as the President may approve, but this amount shall not be charged against the fund provided for in this Act.

* * * * *

Approved, March 12, 1914.

AN ACT Making appropriations to supply urgent deficiency in appropriations for the fiscal year nineteen hundred and fourteen and for prior years, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums are appropriated, out of any money in the Treasury not otherwise appropriated, to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and fourteen and for prior years, and for other purposes, namely:

* * * * *

Payment to Panama: To enable the Secretary of State to pay to the Government of Panama the second annual payment due on February twenty-sixth, nineteen hundred and fourteen, from the Government of the United States to the Government of Panama under treaty of November eighteenth, nineteen hundred and three, \$250,000.

* * * * *

On and after July first, nineteen hundred and fourteen, unless otherwise expressly provided by law, no officer or employee of the United States shall be allowed or paid any sum in excess of expenses actually incurred for subsistence while traveling on duty outside of the District of Columbia and away from his designated post of duty, nor any sum for such expenses actually incurred in excess of \$5 per day; nor shall any allowance or reimbursement for subsistence be paid to any officer or employee in any branch of the public service of the United States in the District of Columbia unless absent from his designated post of duty outside of the District of Columbia, and then only for the period of time actually engaged in the discharge of official duties.

* * * * *

PANAMA CANAL.

To continue the construction of the Panama Canal, to be expended under the direction of the President, in accordance with an Act entitled “An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific Oceans,” approved June twenty-eighth, nineteen hundred and two, and Acts amendatory thereof or supplementary thereto, and to continue available until expended:
For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and

other artisans, and their helpers; janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, quartermaster's, subsistence, disbursements, and examination of accounts, \$2,250,000.

For material, supplies, equipment, construction and repairs of buildings, medical aid and support of the insane, and of indigent persons permanently disabled, while in the line of duty and in the employ of the Isthmian Canal Commission, from earning a livelihood, and contingent expenses of the department of sanitation on the Isthmus, \$200,000.

For the following for fortifications and armament thereof for the Panama Canal, to continue available until expended, namely:

Submarine-mine structures: For the construction of mining casemates, cable galleries, torpedo structures, cable tanks, and other structures necessary for the operation, preservation, and care of submarine mines and their accessories on the Canal Zone, \$55,000.

For the construction of field fortifications, \$194,350.

Such portion of the appropriation of \$180,000 made in the sundry civil appropriation Act approved June twenty-third, nineteen hundred and thirteen, for filling swamp in rear of defensive works at Margarita Island as may not be required for that purpose may be applied to filling swamp land in the vicinity of the defensive works at Toro Point.

For the purpose of paying the expenses of formally and officially opening the Panama Canal as provided in section four of the Panama Canal Act, including the compensation of such persons as may be appointed by the President to provide for such opening under the direction of the Governor of the Panama Canal, the President is authorized to use out of the moneys heretofore or hereafter appropriated for the construction, completion, operation, or maintenance of the Panama Canal, the sum of \$25,000, or so much thereof as may be necessary. The appointment of persons in the military and naval service of the United States is hereby expressly authorized: *Provided*, That, if any person so appointed shall be employed in either the military or naval service of the United States, the amount of compensation fixed by the President under this resolution shall be in addition to the official salary paid to such person.

The wage scale of the persons employed in the construction of the Panama Canal in effect prior to April first, nineteen hundred and fourteen, shall continue unchanged during the period of actual construction, but not later than June thirtieth, nineteen hundred and sixteen; and no claim of any person employed in connection with the construction of the Panama Canal shall be recognized or paid by the United States for longevity service or lay-over days accruing subsequently to June thirtieth, nineteen hundred and nine.

Authority is hereby given to employ and pay, from appropriations heretofore or hereafter made, an attorney versed in the Spanish law, and familiar with the conditions on the Isthmus in connection with the acquisition of privately owned lands in the Canal Zone, and in connection with the codification of the Canal Zone laws, at a salary not to exceed \$7,200 per annum.

* * * * *

SEC. 5. That no part of any money appropriated in this or any other Act shall be used for compensation or payment of expenses of accountants or other experts in inaugurating new or changing old methods of transacting the business of the United States or the District of Columbia unless authority for employment of such services or payment of such expenses is stated in specific terms in the Act making provision therefor and the rate of compensation for such services or expenses is specifically fixed therein, or be used for compensation of or expenses for persons, aiding or assisting such accountants or other experts, unless the rate of compensation of or expenses for such assistants is fixed by officers or employees of the United States or District of Columbia having authority to do so, and such rates of compensation or expenses so fixed shall be paid only to the persons so employed.

Approved, April 6, 1914.

AN ACT To amend section five of "An Act to provide for the opening, maintenance, protection, and operation of the Panama Canal and the sanitation and government of the Canal Zone," approved August twenty-fourth, nineteen hundred and twelve.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the second sentence in section five of the Act entitled "An Act to provide for the opening, maintenance, protection, and operation of the Panama Canal, and the sanitation and government of the Canal Zone," approved August twenty-fourth, nineteen hundred and twelve, which reads as follows: "No tolls shall be levied upon vessels engaged in the coastwise trade of the United States," be, and the same is hereby, repealed.

Sec. 2. That the third sentence of the third paragraph of said section of said Act be so amended as to read as follows: "When based upon net registered tonnage for ships of commerce the tolls shall not exceed \$1.25 per net registered ton, nor be less than 75 cents per net registered ton, subject, however, to the provisions of article nineteen of the convention between the United States and the Republic of Panama, entered into November eighteenth, nineteen hundred and three": *Provided*, That the passage of this Act shall not be construed or held as a waiver or relinquishment of any right the United States may have under the treaty with Great Britain, ratified the twenty-first of February, nineteen hundred and two, or the treaty with the Republic of Panama, ratified February twenty-sixth, nineteen hundred and four, or otherwise, to discriminate in favor of its vessels by exempting the vessels of the United States or its citizens from the payment of tolls for passage through said canal, or as in any way waiving, impairing, or affecting any right of the United States under said treaties, or otherwise, with respect to the sovereignty over or the ownership, control, and management of said canal and the regulation of the conditions or charges of traffic through the same.

Approved, June 15, 1914.

AN ACT To authorize and direct Colonel George W. Goethals, Governor of the Canal Zone, and formerly chairman and chief engineer of the Isthmian Canal Commission, to investigate certain claims of the McClintic-Marshall Construction Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Colonel George W. Goethals, Governor of the Canal Zone, and formerly chairman and chief engineer of the Isthmian Canal Commission, is hereby authorized and directed to investigate the claims of the McClintic-Marshall Construction Company, a corporation of the State of Pennsylvania, having its principal office in the city of Pittsburgh, in said State, and to ascertain what amount, if any, is in justice, equity, and fairness due and owing to the said McClintic-Marshall Construction Company from the Isthmian Canal Commission for work and labor done and materials furnished in connection with the construction and erection of lock gates and appurtenances for the Panama Canal, and in connection with or incidental to the doing of the work and furnishing of the materials provided for in a certain contract between the Isthmian Canal Commission and said McClintic-Marshall Construction Company, dated June twenty-first, nineteen hundred and ten, taking into consideration the claim of the contractors that the work was done under requirements as to character and finish not fairly within the meaning of the specifications.

The said Colonel George W. Goethals, Governor of the Canal Zone, is further authorized and empowered, either personally or through such commission as he may appoint, to investigate such claims and the various items thereof in such manner as to him may seem best, and either personally or through such commission is hereby empowered to administer oaths and affirmations to witnesses, and to issue subpoenas and to compel the attendance of witnesses. He shall report in detail to the Congress of the United States his findings.

Approved, June 24, 1914.

AN ACT Making appropriations for the Diplomatic and Consular Service for the fiscal year ending June thirtieth, nineteen hundred and fifteen.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and they are hereby, severally appropriated, in full compensation for the Diplomatic and Consular Service for the fiscal year ending June thirtieth, nineteen hundred and fifteen, out of any money in the Treasury not otherwise appropriated, for the objects hereinafter expressed, namely:

* * * * *

RELIEF AND PROTECTION OF AMERICAN SEAMEN.

Relief and protection of American seamen in foreign countries, and shipwrecked American seamen in the Territory of Alaska, in the Hawaiian Islands, Porto Rico, the Panama Canal Zone, and the Philippine Islands, \$20,000.

* * * * *

Approved, June 30, 1914.

JOINT RESOLUTION Extending appropriations for the necessary operations of the Government and of the District of Columbia under certain contingencies.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That all appropriations for the necessary operations of the Government and of the District of Columbia which shall remain unprovided for on the thirtieth day of June, nineteen hundred and fourteen, are continued and made available for and during the first half of the month of July, nineteen hundred and fourteen, unless the regular appropriations provided therefor in bills now pending in Congress shall have been previously made for the service of the fiscal year ending June thirtieth, nineteen hundred and fifteen; and a sufficient amount is appropriated, out of any money in the Treasury not otherwise appropriated, to carry on the same: *Provided,* That no greater amount shall be expended for such operations than as the sum of one twenty-fourth of the appropriations made for the fiscal year nineteen hundred and fourteen bears to the whole of the appropriations of said fiscal year: *Provided further,* That the total expenditures for the whole of the fiscal year nineteen hundred and fifteen under the several appropriations hereby continued, and under the several appropriation bills now pending, shall not exceed in the aggregate the amounts finally appropriated therefor in the several bills now pending, except in cases where a change is made in the annual, monthly, or per diem compensation or in the numbers of officers, clerks, or other persons authorized to be employed by the several appropriations hereby continued, in which cases the amounts authorized to be expended shall equal one twenty-fourth of the appropriations for the fiscal year nineteen hundred and fourteen, and twenty-three twenty-fourths of the appropriations contained in the several bills now pending when the same shall have been finally passed, unless the salary or compensation of any office shall be increased or diminished without changing the grade or the duties thereof, in which case such salary or compensation shall relate to the entire fiscal year and run from the beginning thereof
* * *

Approved, June 30, 1914.

AN ACT Making appropriations for the naval service for the fiscal year ending June thirtieth, nineteen hundred and fifteen, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and they are hereby, appropriated, to be paid out of any money in the Treasury not otherwise appropriated, for the naval service of the Government for the year ending June thirtieth, nineteen hundred and fifteen, and for other purposes:

PAY, MISCELLANEOUS.

* * * * *

CONTINGENT, NAVY.

* * * * *

That the sum of \$104,000, or so much thereof as may be necessary, be expended. on the approval and authority of the Secretary of the Navy, for entertaining the officers and crews of foreign fleets which may be sent to attend and participate in the Panama-Pacific International Exposition in consequence of the invitation of the President of the United States, extended in pursuance of the authority contained in the joint resolution of Congress approved February fifteenth, nineteen hundred and eleven and of the authority contained in the Act making appropriations for the naval service for the fiscal year ending June thirtieth, nineteen hundred and twelve, and for other purposes, approved March fourth, nineteen hundred and eleven, and for defraying such other expenses incident to the visit of the said foreign fleets as the Secretary of the Navy may deem proper, and the said sum shall be available until November fifteenth, nineteen hundred and fifteen.

That the tolls that have been or may be prescribed by the President, in pursuance of the authority contained in the Panama Canal Act, approved August twenty-fourth, nineteen hundred and twelve, to be levied by the Government of the United States for the use of the Panama Canal shall not be assessed against nor collected from any war vessel of any foreign nation which may pass through the Panama Canal en route to or in returning from the Panama-Pacific International Exposition: *Provided,* That such vessel has been sent by its Government to attend and participate in the said exposition in consequence of the invitation of the President of the United States,

extended in pursuance of the authority contained in the joint resolution of Congress approved February fifteenth, nineteen hundred and eleven, and of the authority contained in the Act making appropriations for the naval service for the fiscal year ending June thirtieth, nineteen hundred and twelve, and for other purposes, approved March fourth, nineteen hundred and eleven.

The Secretary of the Navy is hereby authorized and empowered to define and establish suitable anchorage grounds in Hampton Roads, Virginia, and the adjacent waters for the combined fleets of the United States and foreign Governments which may rendezvous there prior to proceeding to the Panama-Pacific International Exposition, to be held at the city and county of San Francisco, California, in the year nineteen hundred and fifteen, as well as to define and establish suitable anchorage grounds in the Bay of San Francisco and the approaches and waters adjacent thereto during the continuance of the said Panama-Pacific International Exposition, and the Secretary of the Navy is hereby further authorized to make such rules and regulations regarding the movements of all vessels in all of the waters named as may be necessary in order to insure the proper and orderly conduct of such features as may be planned for the combined fleets and to provide for the safety of the vessels participating therein; and such rules and regulations when so issued and published shall have the force and effect of law.

* * * * *

BUREAU OF STEAM ENGINEERING.

* * * * *

Toward the purchase and preparation of necessary sites, purchase and erection of towers and buildings, and the purchase and installation of machinery and apparatus of high power radio stations (cost not to exceed \$1,000,000), to be located as follows: One in the Isthmian Canal Zone, one on the California coast, one in the Hawaiian Islands, one in American Samoa, one on the island of Guam, and one in the Philippine Islands, \$400,000, to be available until expended.

* * * * *

Approved, June 30, 1914.

EXECUTIVE ORDER.

To Prohibit the Unauthorized use of Flying Machines.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone:

Section 1. It shall be unlawful for any person to operate an aeroplane, balloon or flying machine of any kind in or across the Canal Zone without the written authority of the Chief Executive of the Canal Zone.

Section 2. It shall be unlawful for any person to take or make a photograph, picture or sketch of any kind of the fortifications or other military works in the Canal Zone from any aeroplane, balloon or flying machine of any kind without the written consent of the Chief Executive of the Canal Zone.

Section 3. A violation of any of the provisions of this order shall be punishable by a fine not exceeding One Thousand dollars or by imprisonment in jail not exceeding one year, or by both such fine and imprisonment in the discretion of the Court.

Section 4. This order shall take effect on and after thirty days from its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE, 7 August, 1913.

[No. 1810.]

EXECUTIVE ORDER.

Richard Lee Metcalfe is hereby appointed a member of the Isthmian Canal Commission at the rate of Fourteen Thousand Dollars (\$14,000.00) per annum, effective this date.

Commissioner Metcalfe will be allowed the use of a furnished dwelling house on the Isthmus of Panama and will be allowed and paid his actual and necessary expenses while away from the Isthmus on official business.

WOODROW WILSON

THE WHITE HOUSE, August 9, 1913.

[No. 1812.]

EXECUTIVE ORDER.

Relating to Bail Bonds and Money Deposits in Lieu Thereof, and to Amend Section 310 of Criminal Procedure of the Canal Zone.

By virtue of the authority vested in me, I hereby establish the following Executive Order for the Canal Zone:

Section 1. The defendant in a criminal proceeding before a District Court of the Canal Zone may make a cash deposit in lieu of a bail bond in form and manner as provided for in sections 305, 306, and 307 of the Criminal Procedure Act No. 15 of the Canal Zone, and a certificate of deposit shall be issued to the defendant by the judge in each case.

Section 2. Whenever a warrant is issued by any court or judge of the Canal Zone in a case in which bail may be admitted, the court or judge issuing such warrant shall endorse thereon the amount of bail to be required of the defendant to secure his appearance in the case, and the officer executing the warrant may accept a bail bond or money deposit in lieu thereof in the sum specified in the warrant, and in the form prescribed by law, and the bail bond or money deposit in lieu thereof shall be forthwith delivered to the court having jurisdiction of the case, and a receipt for such bond or deposit shall be given to such officer by the clerk of the court, or the judge thereof if the case is pending in a district court.

When an arrest is made without a warrant in conformity with law in a misdemeanor case, and for any reason the officer making the arrest is unable to take the offender forthwith before a magistrate, he may accept bond or a cash deposit in lieu thereof from the offender in a sum not exceeding five hundred dollars to secure his appearance before the court having jurisdiction of the case, and the offender shall then be released from custody and the bond or cash deposit in lieu thereof shall be delivered to the proper officer or court as hereinbefore provided for in this section.

When a money deposit is made in lieu of bail bond, the deposit shall be held and disposed of in accordance with the provisions of sections 305, 306, 307, and 311 of the Criminal Procedure of the Canal Zone, and section 310 thereof, as hereinafter amended.

Section 3. That section 310 of the Criminal Procedure of the Canal Zone is amended to read as follows:

Section 310. If money has been deposited instead of bail, and the defendant, at any time before the forfeiture thereof, surrenders himself to the officer to whom the commitment was directed, in the manner provided in the two preceding sections, the court must order a return of the deposit to the defendant, upon producing the certificate of the officers showing the surrender, and upon a notice of five days to the Prosecuting Attorney, with a copy of the certificate.

Section 4. This Order shall take effect from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
29 Aug., 1913.

[No. 1817.]

EXECUTIVE ORDER.

Lieutenant-Colonel D. DuB. Gaillard, Corps of Engineers, U. S. A., Member of the Isthmian Canal Commission now on leave of absence, will be retained as a Member of the Isthmian Canal Commission and is hereby granted leave of absence with full pay on status of sick leave, until further notice.

By direction of the President:

LINDLEY M. GARRISON,
Secretary of War.

WAR DEPARTMENT,
September 20, 1913.

EXECUTIVE ORDER.

To punish deported persons who return to the Canal Zone.

By virtue of the authority vested in me I hereby establish the following Order for the Canal Zone:

Section 1. Any person who, after having served a sentence of imprisonment in the Canal Zone and after being deported therefrom, returns to the Canal Zone shall be

deemed guilty of felony and punished by imprisonment in the penitentiary for a term of not less than six months nor more than two years, and upon the completion of his sentence he shall be removed from the Canal Zone in accordance with the laws and orders relating to deportation. An entry into the Canal Zone, for any purpose, shall be sufficient to constitute a return to the Zone within the meaning of this Order; provided, however, that in a case of necessity the Chief Executive of the Canal Zone, in his discretion, may grant a permit to any such person to return to the Canal Zone temporarily, but should he remain in the Canal Zone after the time specified in the permit he shall be deemed guilty of a violation of this Order and punished as therein provided.

Section 2. The Executive Order of May 2, 1911, providing a punishment for deported persons who return to the Canal Zone is hereby repealed.

Section 3. This Order shall take effect thirty days from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
25 Sept., 1913.

[No. 1832.]

EXECUTIVE ORDER.

To Regulate the Carrying of Arms.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone:

Section 1. Anyone who carries on or about his person any firearm, dirk, dagger or other knife manufactured or sold for the purpose of offence or defence, or any slung-shot, sword-cane, or any knuckles made of metal or other hard substance, shall be punished by fine of not less than Five Dollars nor more than Twenty-five Dollars, or by imprisonment in jail of not less than five days nor more than thirty days, or by both such fine or imprisonment in the discretion of the court, and during such time of imprisonment such offender may be put to work upon any public work in the Canal Zone.

In addition to the punishment herein prescribed for unlawfully carrying arms, the courts shall adjudge the seizure and confiscation of the arms unlawfully carried by the offending party and the same shall be disposed of in such manner as the Head of the Department of Civil Administration shall determine.

Section 2. The preceding section shall not apply to a person engaged in the military or naval service of the United States or as a peace officer or officer authorized to execute judicial process of the United States or the Canal Zone, or in carrying mail or engaged in the collection or custody of funds of the United States or the Canal Zone, nor to a member of a gun or pistol club for the promotion of target practice, a certified copy of the constitution and by-laws of which have been approved by the Head of the Department of Civil Administration, and filed with the Collector of Revenues, when such member is going to or from a target range, and engaged in practice at the target range. For the purposes of this order, a certificate of membership in the gun or pistol club shall be issued by the organization and approved by the Head of the Department of Civil Administration, and shall entitle the holder to carry firearms as provided for in this section.

Neither shall the preceding section apply to any person authorized to have or carry arms by permit granted under the terms and conditions named in section 3 hereof.

Section 3. The Head of the Department of Civil Administration may authorize the granting of permits to have and carry arms as follows:

1. To hunt upon the public lands of the Canal Zone, or upon the lands of private persons when authorized by the latter.

2. To have arms in residences, offices, business places and plantations; and to watchmen or overseers of plantations, factories, warehouses, docks or piers.

Applications for such permits shall be made to the Head of the Department of Civil Administration and shall state the full name, residence and occupation of the applicant, and if the applicant is a minor it shall not be granted without the written consent of his parent or guardian.

The Head of the Department of Civil Administration shall satisfy himself by due inquiry that the applicant is a proper person to have a permit to keep or carry arms, and he may grant or deny the application as to him may seem proper.

When an application is granted by the Head of the Department of Civil Administration for a permit to hunt he shall file the application, with his approval endorsed thereon, with the Collector of Revenues, who shall issue a permit to the applicant upon his paying the Collector of Revenues a fee of one dollar, to be covered into Treasury of the Canal Zone Government.

The hunting permits issued by virtue of this order shall authorize the holders thereof to have, use or carry a gun, rifle or other similar long arm for hunting purposes during the fiscal year for which the permit is issued, provided, however, that such permit may be revoked at any time for cause by the Head of the Department of Civil Administration.

Section 4. Anyone who engages in hunting without first obtaining the permit provided for in this order shall be subject to a fine not exceeding Twenty-five dollars or imprisonment in jail not exceeding ten days, provided, however, that persons engaged in the land or naval forces of the United States shall not be required to obtain a permit to hunt upon the public lands of the Canal Zone.

Section 5. Penalties for infringement of this order imposed upon intoxicated or disorderly persons shall be in addition to the punishments authorized by law for such intoxicated or disorderly conduct.

Section 6. Sections 449 to 460, both inclusive, of the Penal Code, the Executive Order of December 1, 1909, issued by the Secretary of War by authority of the President, amending Sections 450 and 456 of the Penal Code, and the Executive Order of the Secretary of War, issued by authority of the President, dated November 3, 1911, amending Section 456 of the Penal Code as amended by the Executive Order above mentioned, and all other laws, orders and decrees in conflict with this order are hereby repealed.

Section 7. This order shall take effect thirty days from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
7 November, 1913.

[No. 1857.]

EXECUTIVE ORDER.

Fixing the Rate of Interest on Money.

By virtue of the authority vested in me I hereby establish the following Executive Order for the Canal Zone:

Section I. No rate of interest shall be allowed in excess of six percentum per annum upon any contract for the use or detention of money, unless the same is in writing and the interest agreed upon must not exceed twelve percentum per annum.

Section II. All contracts whatsoever which may in any way, directly or indirectly, violate the preceding section by stipulating for a greater rate of interest than twelve per centum per annum, shall be void and of no effect for the amount or value of the interest only; but the principal sum of money or value of the contract may be received and recovered.

Section III. When the interest received or collected for the use or detention of money exceeds the rate of twelve percentum per annum, it shall be deemed to be usurious, and the person or persons paying the same, or their legal representatives, may recover from the person, firm or corporation receiving such interest, the amount of the interest so received or collected, in any court of competent jurisdiction, within two years from the date of the payment of such interest.

Section IV. No evidence of usury shall be received on the trial of any case unless the same shall be pleaded and verified by the affidavit of the party wishing to avail himself of such defense.

Section V. This Order shall take effect thirty days from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
11 Nov., 1913.

[No. 1860.]

[Rules for the measurement of vessels for the Panama Canal.]

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

A PROCLAMATION.

I, WOODROW WILSON, President of the United States of America, by virtue of the power and authority vested in me by the Act of Congress, approved August twenty-fourth, nineteen hundred and twelve, to provide for the opening, maintenance, protection and operation of the Panama Canal and the sanitation and government of the Canal Zone, do hereby prescribe and proclaim the "Rules for the Measurement of Vessels for the Panama Canal," which are annexed hereto and made a part of this proclamation.

In witness whereof, I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the city of Washington this twenty-first day of November in the year of our Lord one thousand nine hundred and thirteen and of the independence of the United States the one hundred and thirty-eighth.

[SEAL.]

WOODROW WILSON

By the President:

W. J. BRYAN

Secretary of State.

[No. 1258.]

RULES FOR THE MEASUREMENT OF VESSELS FOR THE PANAMA CANAL.

All vessels to present tonnage document at canal.

ARTICLE I. All vessels, American and foreign, except warships, including vessels of commerce and Army and Navy transports, colliers, supply ships, and hospital ships, applying for passage through the Panama Canal shall present a duly authenticated certificate stating the vessel's gross and net tonnage as determined by these rules. Vessels of commerce, Army and Navy transports, colliers, supply ships, and hospital ships, without such certificate shall before passing through the canal, or before being allowed to clear therefrom, be measured, and shall have their gross and net tonnage determined in accordance with these rules.

All warships, American and foreign, other than transports, colliers, supply and hospital ships, shall present duly authenticated displacement scale and curves stating accurately the tonnage of displacement at each possible mean draft.

Vessels designated as "supply ships" and "colliers."

It is to be understood that "supply ships" shall include Army and Navy ammunition ships, refrigerator ships, distilling ships, repair ships submarine tenders, and destroyer tenders, as well as Army and Navy vessels used to transport general Army and Navy supplies; and that "colliers" shall include Army and Navy vessels used to transport coal or fuel oil.

RULES APPLYING TO VESSELS OF COMMERCE, ARMY AND NAVY TRANSPORTS, COLLIERS, SUPPLY SHIPS, AND HOSPITAL SHIPS.

GROSS TONNAGE.

What shall be included in gross tonnage.

ART. II. Gross tonnage as determined by these rules shall express the total capacity of vessels, i. e., the exact cubical contents of all spaces below the upper deck and of all permanently covered and closed-in spaces on or above that deck, excepting such spaces as may be hereinafter permitted as exemptions from measurement. Gross tonnage shall include not only all permanently covered and closed-in spaces which are or may be used for stowing cargo and stores or for providing shelter and other comfort for passengers or crew, but also such spaces as are used, or are intended to be used, in navigating and serving the vessel.

Only such spaces as are specifically mentioned in Article IV, below, shall be exempted from measurement. All other spaces shall be considered as closed-in and shall be included in gross tonnage.

What shall be considered permanently covered and closed-in spaces.

ART. III. By permanently covered and closed-in spaces on or above the upper deck are to be understood all those which are separated off by decks or coverings, or fixed partitions, and which, therefore, represent an increase of capacity that is or may be used for the stowage of cargo, or for the berthing and accommodation of the passengers, the officers, or the crew. No break in a deck, nor any opening or openings in a deck or the covering of a space or in the partitions or walls of a space, nor the absence of a partition shall prevent a space from being measured and comprised in gross tonnage if the opening or openings in the deck, partition, or side wall can be closed in, or if the absent partition can be put in place, after admeasurement and the spaces thus closed in be thereby better fitted for the transport of goods or passengers.

In the case of a vessel having a "trunk" or "turret", the deck forming the covering of the trunk or turret shall be considered the upper deck, and all spaces below that deck within the trunk or turret shall be considered as covered and closed-in. The space within the turret or trunk shall be measured as are other between-deck spaces.

Spaces considered as "permanently closed-in" and spaces permitted to be exempted from measurement shall be determined solely by the provisions contained in these rules, and not by any definitions or provisions contained in the measurement rules or regulations of any country.

Spaces exempted from measurement and gross tonnage.

ART. IV. The following spaces shall be exempted from measurement and shall not be included in the gross tonnage, and no other spaces shall be exempted:

SECTION 1. Spaces on or above the upper deck not permanently covered or closed-in, or which may not be readily covered or closed-in. In the application of this rule it will be understood that—

(a) Spaces under decks or coverings having no other connection with the body of the ship than the stanchions necessary for their support are not spaces separated off, but are spaces permanently exposed to the weather and the sea and are not to be included in the gross tonnage.

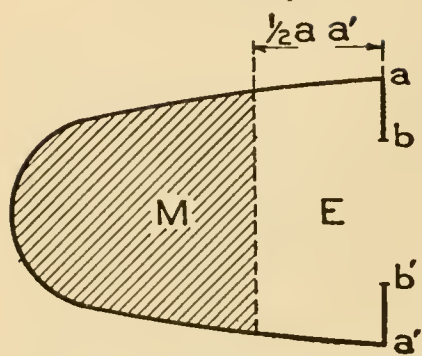
(b) A space within a poop, forecastle, bridge house, or other "permanently covered and closed-in" superstructure or erection may be considered as not permanently covered or closed-in, and may consequently be excluded from tonnage, if the space is opposite an end opening which is without a coaming and has no headplates or planks and is not provided with means of closing, and which opening has a breadth equal to or greater than half the breadth of the deck at the line of the opening, and if the space opposite the opening can not be used to shelter other merchandise than cargo or stores that do not require protection from the sea. If the opening is fitted with a coaming, the space within it is to be included in the gross tonnage. This provision shall be so applied as to exempt from measurement only the space between the actual end opening and a line drawn parallel to the line or face of the opening at a distance from the opening equal to one-half the width of the deck at the line of the opening; provided, that any closed-in space between the open face and the line drawn parallel to it shall be measured. The remainder of the space within a poop, forecastle, bridge house, or other superstructure or erection shall be considered as available for the accommodation of cargo or stores, of passengers or of the ship's personnel, and shall be measured and included in the gross tonnage. (See Figs. 1, 2, and 3.)

Should the open space within a poop, forecastle, bridge house, superstructure, or erection between the end opening and a parallel line distant from the opening by half the breadth of the deck become, because of any arrangement, of less width than half the breadth of the deck, then only the space between the line of the end opening and a parallel line drawn through the point where the athwartship width of the open space within the poop, forecastle, bridge house, superstructure, or erection becomes equal to, or less than, half the breadth of the deck shall be exempted from measurement. (See Figs. 4, 5, 6, and 7.) The remainder of the space within the poop, forecastle, bridge house, superstructure, or erection is to be included in the gross tonnage.

When two erections extending from side to side of the ship are separated by an interval the fore-and-aft length of which is less than the least half breadth of the deck in way of such interval, then whatever be the breadth of the permanent end openings of the erections, the entire erections, less the interval separating them, shall be measured and included in the gross tonnage. (See Fig. 8.)

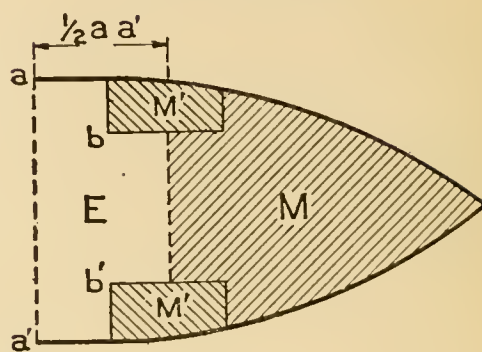
(c) In a poop, forecastle, side-to-side bridge house, or other "permanently covered and closed-in" superstructure or side-to-side erection the space directly in way of opposite openings, the height of which is at least 3 feet, in the side walls of the ship not provided with means of closing and corresponding to each other in the opposite walls of the ship shall be exempted. (See Figs. 9 and 10.)

FIG. 1.—Poop.



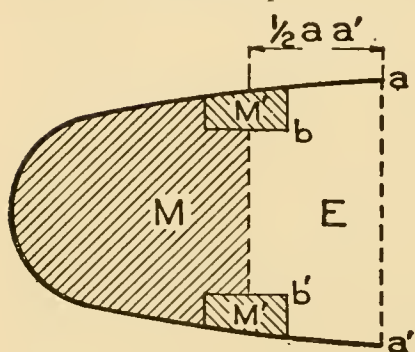
$bb' > \frac{1}{2} aa'$.
E=space exempted.
M=space measured.

FIG. 3.—Forecastle.



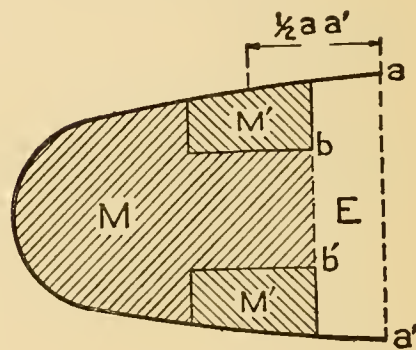
$bb' > \frac{1}{2} aa'$.
E=space exempted.
M'=closed-in houses, measured.
M=space measured.

FIG. 2.—Poop.



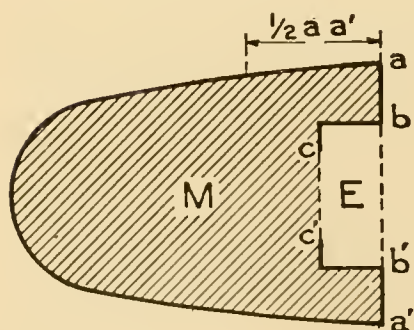
$bb' > \frac{1}{2} aa'$.
E=space exempted.
M'=closed-in houses, measured.
M=space measured.

FIG. 4.—Poop.



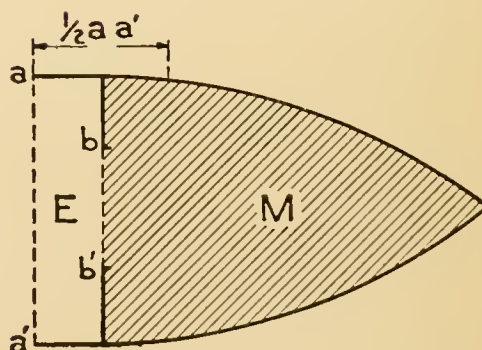
$bb' < \frac{1}{2} aa'$.
E=space exempted.
M'=closed houses, measured.
M=space measured.

FIG. 5.—Poop.



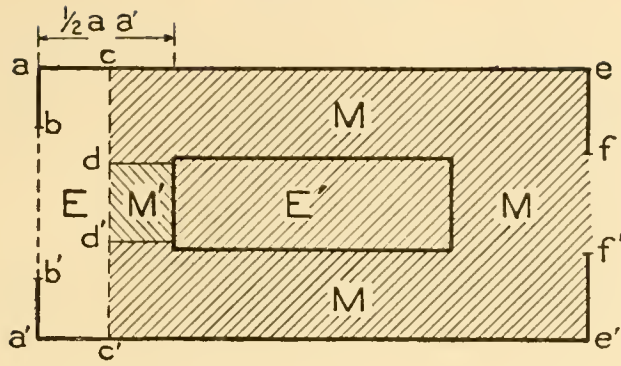
$bb' > \frac{1}{2} aa'$.
 $cc' < \frac{1}{2} aa'$.
E=space exempted.
M=space measured.

FIG. 6.—Forecastle.

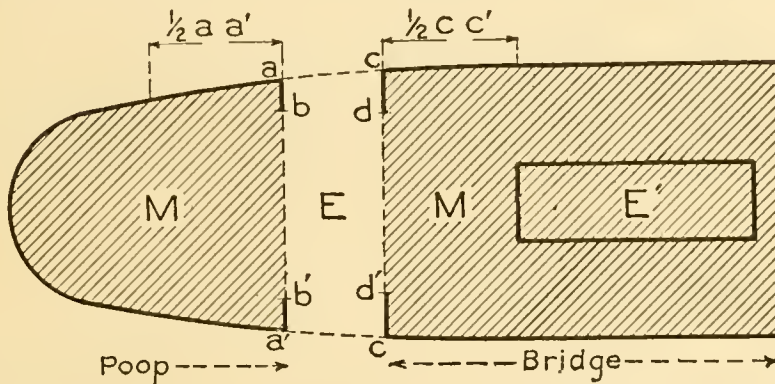


$bb' < \frac{1}{2} aa'$.
E=space exempted.
M=space measured.

FIG. 7.—Bridge.

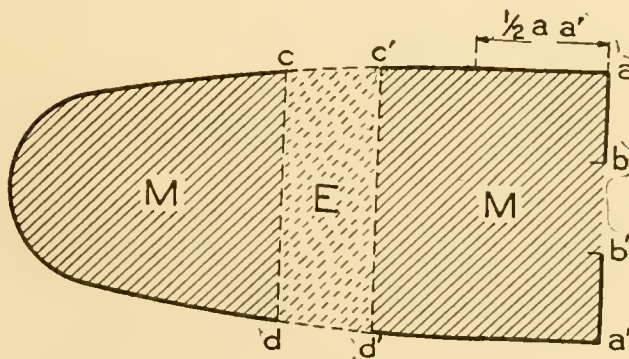


$bb' > \frac{1}{2} aa'$.
 $cd < \frac{1}{2} aa'$.
 $c'd' < \frac{1}{2} aa'$.
 $ff' < \frac{1}{2} ee'$.
 E=space exempted.
 E'=light and air and funnel space in lowest tier of erections, measured under Art. IV, Sec. 3.
 M=space measured.
 M'=closed house, measured.

FIG. 8.—Poop and Bridge with interval less than $\frac{1}{2}$ the least half breadth of the Deck in way of interval.

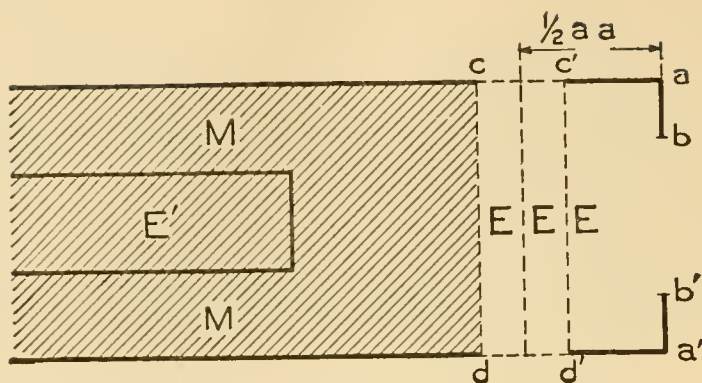
$ac < \frac{1}{2} aa'$.
 $a'e' < \frac{1}{2} aa'$.
 $bb' > \frac{1}{2} aa'$.
 $dd' > \frac{1}{2} ee'$.
 M=spaces measured.
 E=space exempted.
 E'=light and air and funnel space in lowest tier of erections, measured under Art. IV, sec. 3.

FIG. 9.—Poop.



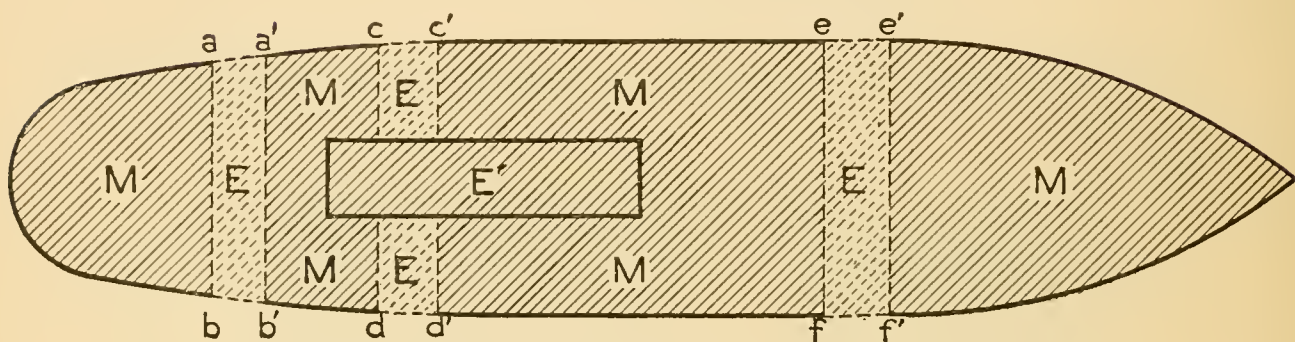
ce' and dd' =side openings under deck covering.
 E=space exempted.
 $bb' < \frac{1}{2} aa'$.
 M=spaces measured.

FIG. 10.—Bridge.



$bb' > \frac{1}{2} aa'$.
 cc' and dd' = side openings.
 E = spaces exempted.
 M = space measured.
 E' = light and air and funnel space, in lowest tier of erections, measured under Art. IV, sec. 3.

FIG. 11.—Continuous deck with opposite side openings.



$(aa') (bb') (cc') (dd') (ee') (ff')$ = side openings.
 E = spaces exempted opposite side openings below continuous deck.
 M = spaces measured.
 E' = light and air and funnel space, measured under Art. IV, sec. 3.

SEC. 2. Spaces in way of opposite side openings at least 3 feet in height not provided with means of closing shall be exempted. In the case of a continuous deck with one or more deck openings (usually designated as tonnage openings) that may be so closed as to permit cargo or stores to be carried in the space under the deck, or under portions thereof, only the spaces under such a deck that are exactly in way of opposite openings at least 3 feet in height in the side walls of the ship not provided with means of closing and corresponding to each other in the opposite walls of the ship shall be exempted; and the remaining spaces under such a deck shall be measured and included in gross tonnage. In case the openings in the side walls of the ship are provided with means of closing, no portion of the space under such a deck shall be exempted. (Fig. 11.)

SEC. 3. The spaces framed in round the funnels and the spaces required for the admission of light and air into the engine rooms shall be exempted from measurement to the extent that such spaces are above the deck or covering of the first or lowest tier of side-to-side erections, if any, on the upper deck. A deck with one or more deck openings (usually designated as tonnage openings) that may be so closed as to permit cargo or stores to be carried in the space under the deck or portions thereof is to be considered as the upper deck, provided that no space beneath it abreast side openings is exempted under the provisions of section 2. There shall, however, be measured and included within gross tonnage the spaces situated within closed-in side-to-side erections on the upper deck, spaces framed in round the funnels and those required for the admission of light and air to the extent that such light and air and funnel spaces are below the deck or covering of the first or lowest tier of such side-to-side erections on the upper deck. There shall be exempted from the measurement of any superstructure or erection situated above the first or lowest tier of side-to-side erections on the upper deck such portion or portions thereof as are occupied by the spaces framed in round the funnels or by the spaces required for the admission of light and air into the engine rooms. Such exempted spaces must not be used for any other than their designated purpose and must be reasonable in extent.

SEC. 4. Space or spaces between the inner and outer plating of the double bottom of a vessel that are so inclosed and that have such openings as to make them usable only for water ballast shall be exempted from measurement; but such spaces within the double bottom as are or may be used for carrying cargo, stores, feed water, coal, or other fuel shall be measured and included in the gross tonnage.

SEC. 5. The cubical contents of hatchways shall be obtained by multiplying the length and breadth together and the product by the mean depth taken from the top of beam to the underside of the hatch. From the aggregate tonnage of the hatchways there shall be deducted one-half of 1 per cent of the vessel's gross tonnage, exclusive of hatchways, and only the remainder shall be added to the gross tonnage of the ship, exclusive of the tonnage of the hatchways.

SEC. 6. Companionways and companion houses shall be exempted when used solely as companionways or companion houses. When used as smoking rooms or for any other purposes than companionways or companion houses, the parts so used shall be measured and included in gross tonnage.

SEC. 7. Domes and skylights shall be exempt from measurement. When there is an opening in the floor of a superstructure immediately below a skylight, the exemption shall include the space between the skylight and the opening in the floor of the superstructure immediately under the skylight. The remainder of the superstructure shall be included in the measurement. The space, in addition to the skylight, that may be exempted by this rule is that indicated by A, B, C, D in the following drawing:

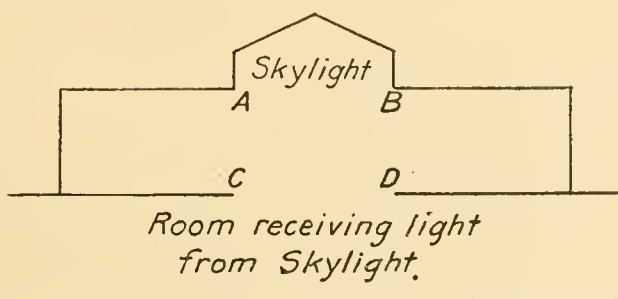


FIG. 12.—Open space under skylight.

Exempted spaces, if used, must be added to gross tonnage.

ART. V. Should a vessel at any time stow cargo of any kind, bunker coal or other fuel, or stores of any description in any portion whatever of any exempted space, except spaces exempted under Art. IV, Sec. 1, Par. (b) and spaces on open decks not permanently covered, or upon decks as defined in Art. IV, Sec. 1, Par. (a), of these rules, the whole of that space shall be measured and added to the gross tonnage, and the space shall not thereafter be exempted from measurement.

Spaces available for passengers not to be exempted.

ART. VI. Spaces for the use or possible use of passengers shall not be exempted from measurement except as stated in Article IV, section 1, paragraph (a).

In case of Army and Navy transports, colliers, supply ships, and hospital ships as defined in Article I, the term "passengers" shall include all officers, enlisted men, and other persons who are not assigned to duty and who are not duly inscribed on the ship's rolls.

Tonnage upon which charges are payable shall be increased by space occupied by cargo carried upon deck in spaces not permanently covered and closed in.

ART. VII. If any ship carries stores, timber, cattle, or other cargo in any space upon an open deck not permanently covered or in spaces exempted under Art. IV, Sec. 1, Pars. (a) and (b) of these rules, all tolls and other charges payable on the vessel's net tonnage shall be payable upon the vessel's net tonnage (as defined below in Articles X and XII) increased by the tonnage of the space occupied (at the time at which the tolls or other charges become payable) by the goods carried upon deck and not permanently covered or closed-in. The deck space occupied by the goods thus carried shall be determined at the time of the application of the vessel for passage through the canal and shall be deemed to be the space limited by the area occupied by the goods and by straight lines inclosing a rectangular space sufficient to include the goods. The tonnage

of the space occupied by the goods shall be ascertained in the manner prescribed below by Article IX, Rule I, for the measurement of poops or other closed-in spaces.

Nothing in this article shall in any manner affect the provisions of Articles II, III, and IV.

Measurement of the cubical contents of spaces may be by the Moorsom system in each country, or by the Moorsom system as prescribed in these rules.

ART. VIII. The cubical contents of the spaces included, by these rules, in gross tonnage may, in any country where the Moorsom system of measurement has been adopted, be ascertained under that system as applied in measuring vessels for national registry, provided that system is substantially similar to the Moorsom system of measurement as set forth in Article IX of these rules.

Rules for the measurement of contents of spaces.

ART. IX. In countries that have not adopted the Moorsom system of measuring spaces within vessels, the cubical contents of any of the spaces included in gross tonnage shall be ascertained according to the Moorsom system as set forth in the following rules: Rule I for the measurement of empty vessels; Rule II for laden vessels; Rule III for open vessels.

RULE I.—For measuring the gross tonnage of empty vessels.

SECTION 1. The length for the admeasurement of ships having one or more decks is taken on the tonnage deck, which is—

- (a) The upper deck for vessels having one or two decks.
- (b) The second deck from below for vessels having more than two decks.

Measure the length of the ship in a straight line along the upper side of the tonnage deck from the inside of the inner plank (average thickness) at the side of the stem to the inside of the midship stern timber or plank there, as the case may be (average thickness), deducting from this length what is due to the rake of the bow in the thickness of the deck and what is due to the rake of the stern timber in the thickness of the deck, and also what is due to the rake of the stern timber in one-third of the round of the beam; divide the length so taken into the number of equal parts required by the following table, according to the class in such table to which the ship belongs:

Class 1: Ships of which the tonnage deck is, according to the above measurement, 50 feet long or under, into 4 equal parts.

Class 2: Ships of which the tonnage deck is, according to the above measurement, above 50 feet long and not exceeding 120 feet, into 6 equal parts.

Class 3: Ships of which the tonnage deck is, according to the above measurement, above 120 feet long and not exceeding 180 feet, into 8 equal parts.

Class 4: Ships of which the tonnage deck is, according to the above measurement, above 180 feet long and not exceeding 225 feet, into 10 equal parts.

Class 5: Ships of which the tonnage deck is, according to the above measurement, above 225 feet long, into 12 equal parts.¹

In the case of a break or breaks in a double-bottom for water ballast, the length of the vessel is to be taken in parts according to the number of breaks, and each part divided into a number of equal parts according to the class in the above table to which such length belongs.

SEC. 2. Then the hold being first sufficiently cleared to admit of the required depths and breadths being properly taken, find the transverse area of the ship at each point of division of the length or each point of division of the parts of the length, as the case may require as follows: Measure the depth at each point of division, from a point at a distance of one-third of the round of the beam below the tonnage deck, or, in case of a break, below a line stretched in continuation thereof, to the upper side of the floor timber (upper side of the inner plating of the double bottom) at the inside of the limber strake, after deducting the average thickness of the ceiling which is between the bilge planks and the limber strake, subject, however, to the provisions of these rules, Article IV, section 4, regarding the measurement or exemption of double-bottom spaces. In the case of a ship constructed with a double-bottom for water ballast if the space between the inner and outer plating thereof is not available for the carriage of cargo, stores, feed-water, coal, or other fuel, then the depth shall be taken to be the upper side of the inner plating of the double-bottom, and that upper side shall, for the purposes of measurement, be deemed to represent the floor timber

¹A greater number of divisions is permissible provided there be an even number of divisions.

of the vessel. This rule for measuring the depth of the hold applies to double-bottom ships having top of double bottom *not* horizontal.

If the depth at the midship division of the length does not exceed 16 feet, divide each depth into 5 equal parts; then measure the inside horizontal breadth at each of the four points of division, and also at the upper point of the depth, extending each measurement to the average thickness in that part of the ceiling which is between the points of measurement. Number these breadths from above (i. e., numbering the upper breadth 1, and so on down to the fifth breadth); multiply the second and fourth by 4, and the third by 2; add these products together, and to the sum add the first breadth and the fifth. Multiply the quantity thus obtained by one-third of the common interval between the breadths, and the product shall be deemed the transverse area of the upper part of the section; then find the area between the fifth and lower point of the depth by dividing the depth between such points into four equal parts, and measure the horizontal breadths at the three points of division and also at the upper and lower points, and proceed as before, and the sum of two parts shall be deemed to be the transverse area; but if the midship depth exceed 16 feet, divide each depth into 7 equal parts instead of 5, and measure, as before directed, the horizontal breadths at the six points of division, and also at the upper point of the depth; number them from above, as before; multiply the second, fourth, and sixth by 4, and the third and fifth by 2; add these products together, and to the sum add the first breadth and the seventh. Multiply the quantity thus obtained by one-third of the common interval between the breadths, and the products shall be deemed the transverse area of the upper part of the section; then find the lower part of the area as before directed, and add the two parts together, and the sum shall be deemed to be the transverse area.

This section applies to vessels with double bottoms, the tops of which have a rise from the middle line to each side. In vessels in which the top of the double bottom is horizontal, or in which there is no double bottom, the depths are to be divided by 4 or 6 (instead of 5 or 7), according as their midship depths do not or do exceed 16 feet respectively. In such cases no subdivision of the lower part is to be made.

SEC. 3. Number the transverse sections or areas respectively 1, 2, 3, etc., No. 1 being at the extreme limit of the length at the bow, or of each part of the length, and the last number at the extreme limit of the length at the stern or the extreme limit at the after end of each part of the length; then, whether the length be divided according to the table into 4 or 12 parts, as in classes 1 and 5, or any intermediate number, as in classes 2, 3, and 4, multiply the second and every even-numbered area by 4, and the third and every odd-numbered area (except the first and last) by 2; add these products together, and to the sum add the first and last, if they yield anything; multiply the quantity thus obtained by one-third of the common interval between the areas, and the product will be the cubical contents of the space, or cubical contents of each part if the ship is measured in parts under the tonnage deck. The tonnage of this volume is obtained by dividing it by 100, if the measurements are taken in English feet, and by 2.83 if the measurements are taken in meters. The multiplier 0.353 may be used instead of the divisor 2.83.

SEC. 4. If the ship has a third deck the tonnage of the space between it and the tonnage deck shall be ascertained as follows: Measure in feet the inside length of the space at the middle of its height from the plank at the side of the stem to the lining on the timbers at the stern, and divide the length into the same number of equal parts into which the length of the tonnage deck is divided, as above directed; measure (also at the middle of its height) the inside breadth of the space at each of the points of division, also the breadth at the stem and the breadth at the stern; number them successively 1, 2, 3, etc., commencing at the stem; multiply the second and all the other even-numbered breadths by 4, and the third and all the other odd-numbered breadths (except the first and last) by 2; to the sum of these products add the first and last breadths; multiply the whole sum by one-third of the common interval between the breadths, and the result will give in superficial feet the mean horizontal area of the space; measure the mean height of the space, and multiply by it the mean horizontal area, and the product will be the cubical contents of the space; divide this product by 100 (or by 2.83 if the measurements are taken in meters) and the quotient shall be deemed to be the tonnage of the space, and shall be added to the tonnage of the ship ascertained as aforesaid; and if the ship has more than three decks, the tonnage of each space between decks above the tonnage deck shall be severally ascertained in the manner above described, and shall be added to the tonnage of the ship ascertained as aforesaid.

SEC. 5. If there be a break, a poop, or any other permanently covered or closed-in space on or above the upper deck (as defined above in Article III) the tonnage of such space shall be ascertained as follows: Measure the internal mean length of the space in feet, and divide it into two equal parts; measure at the middle of its height three inside breadths, namely, one at each end and the other at the middle of the length; then to

the sum of the end breadths add four times the middle breadth, and multiply the whole sum by one-third of the common interval between the breadths; the product will give the mean horizontal area of the space; then measure the mean height and multiply by it the mean horizontal area; divide the product by 100 (or by 2.83 if the measurements are taken in meters) and the quotient shall be deemed to be the tonnage of the space.

SEC. 6. In measuring the length, breadth, and height of the general volume of the ship or that of the other spaces, reduce to the mean thickness the parts of the ceiling which exceed the mean thickness. When the ceiling is absent, or when it is not permanently fixed, the length and breadth shall be reckoned from the main frames of the ship, not from the web or belt frames. The same principle is to hold in the case of deck erections, that is, the breadth is to be reckoned from the main framing or stiffeners of the same, when ceiling is not fitted. When the main framing of the ship is curved or carried upward and inboard so as to permit the building of topside tanks or compartments outboard of the main framing, the breadth of the ship shall be reckoned from the outboard framing of such outboard tanks, thus including these tanks in the measurement.

RULE II.—*For measuring the gross tonnage of laden ships.*

SEC. 7. When ships have cargo on board, or when for any other reason their tonnage can not be ascertained by means of Rule I, proceed in the following manner:

Measure the length on the uppermost full-length deck from the outside of the outer plank at the stem to the aft side of the sternpost, deducting therefrom the distance between the aft side of the sternpost and the rabbet of the sternpost at the point where the counterplank crosses it. Measure also the greatest breadth of the ship to the outside of the outer planking or wales at the middle perpendicular. Then, having first marked on the outside of the ship on both sides thereof the height of the uppermost full-length deck at the ship's sides, girth the ship at the middle perpendicular in a direction perpendicular to the keel from the height so marked on the outside of the ship, on the one side, to the height so marked on the other side, by passing a chain under the keel; to half the girth thus taken add half the main breadth; square the sum, multiply the result by the length of the ship taken as aforesaid, then multiply this product by the factor 0.17 in the case of ships built of wood, and by the factor 0.18 in the case of ships built of iron or steel. The product will give approximately the cubical contents of the ship, and the tonnage can be ascertained by dividing by 100 or by 2.83, according as the measurements are taken in English feet or in meters.

SEC. 8. If there be a break, a poop, or other permanently covered and closed-in spaces (as defined above in Article III) on or above the uppermost full-length deck, the tonnage of such spaces shall be ascertained by multiplying together the mean inside length, breadth, and depth of such spaces and dividing the product by 100, or 2.83, according as the measurements are taken in English feet or meters, and the quotient so obtained shall be deemed to be the tonnage of the spaces, and shall be added to the other tonnage in order to determine the gross tonnage or total capacity of the ship.

RULE III.—*For measurement of open vessels.*

SEC. 9. In ascertaining the tonnage of open ships, the upper edge of the upper strake of the shell plating is to form the boundary line of measurement, and the depths shall be taken from an athwartship line, extended from upper edge to upper edge of the said strake at each division of the length.

DEDUCTIONS FROM THE GROSS TONNAGE TO ASCERTAIN THE NET TONNAGE.

(A) DEDUCTIONS FOR VESSELS NOT PROPELLED BY ENGINES.

ART. X. The following spaces (enumerated below in secs. 1 to 10 of this article) shall be deducted from the gross tonnage in order to ascertain the net tonnage of *vessels not propelled by engines*, and no other spaces shall be deducted. Unless otherwise expressly stipulated, these spaces shall be deducted whether located above or below the upper deck.

The volume or cubical contents of deducted spaces shall be ascertained in the manner specified in Article VIII or Article IX of these rules. The remainder, resulting from deducting from the total space included in gross tonnage the sum of the cubical contents of the spaces whose deduction from gross tonnage is permitted by these rules, shall be the net or register tonnage of vessels not propelled by engines and unrigged craft upon which tolls and other charges based upon tonnage shall be paid by vessels of commerce, Army and Navy transports, colliers, supply ships, and hospital ships (as defined in Art. I) for passage through the Panama Canal. One hundred cubic feet, or 2.83 cubic meters, shall constitute one gross or net ton.

Spaces for the use, or possible use, of passengers (as defined in Art. VI) shall not be deducted from the gross tonnage, except in so far as their deduction may be specifically provided for in the following sections (1 to 10) of this article of these rules.

Definition of stores and cargo carried on Army and Navy transports, colliers, supply ships, and hospital ships.

Spaces available for the stowage of stores (other than boatswain's stores) or cargo shall not be deducted from gross tonnage. In case of Army and Navy transports, colliers, supply ships, and hospital ships, as defined in Article I, the term "stores (other than boatswain's stores) or cargo" shall include, in addition to goods or cargo ordinarily carried as freight on vessels of commerce, the following articles:

On transports, food, stores, luggage, accouterments, and equipment for passengers.

On colliers, coal, coaling gear, and fuel oil not for the use of the colliers.

On supply ships, stores, supplies of all kinds, distilling machinery and distilled water (other than feed water stored in double-bottom compartments), machines, tools and material for repair work, mines and mining material, torpedoes, arms, and ammunition.

On hospital ships, food stores for passengers, medical stores, and hospital equipment.

Guns mounted on transports and supply ships, for defense of the ships, and ammunition required for use in such guns shall not be classed as cargo.

Deductions from gross tonnage allowed vessels not propelled by engines.

SECTION 1. The tonnage of the spaces or compartments occupied by, or appropriated to the use of, the officers and crew of the vessel shall be deducted. The term "officers and crew" shall include the personnel inscribed on the ship's rolls, i. e., the ship's officers, engineers, doctors, apothecary, sick attendants, sailors, apprentices, firemen, mechanics, and wireless operators; but shall not include clerks, pursers, stewards, and other members of the personnel provided by the ship for the care of the passengers. The spaces or compartments occupied by the officers and crew shall include their berthing accommodations, spaces provided for medical attention, mess rooms, ward and dressing rooms, bath and wash rooms, water-closets, latrines, lavatories, or privies for their exclusive use, and passageways exclusively serving these spaces.

SEC. 2. On hospital ships the spaces or compartments occupied by doctors, apothecary, and sick attendants duly inscribed on the ship's rolls, shall form part of the deduction under section 1 of this article. Spaces provided for the medical attention of the officers and crew of a hospital ship shall likewise be deducted; but spaces fitted for the transportation, or for the medical attention, of other persons than those duly listed in the ship's rolls shall not be deducted.

SEC. 3. The space occupied by the master's cabin shall be deducted.

SEC. 4. Cook houses, galleys, bakeries, laundries, and rooms for ice machines, when used exclusively to serve the officers and crew, and the condenser space, and distilling rooms, when used exclusively for condensing and distilling the water for the officers and crew, shall be deducted.

SEC. 5. Spaces used for the anchor gear, steering gear, and capstan; the wheel house, the dynamo rooms; the chart room used exclusively for keeping charts, signals, and other instruments of navigation; lookout houses; spaces for keeping electric search-lights and wireless telegraph appliances; and other spaces actually used in the navigation of the ship, shall be deducted. Such spaces upon vessels of commerce as may be devoted to the mounting of guns and to the stowage of ammunition for the guns thus mounted shall be deducted. The deduction of all spaces, other than those devoted to the mounting of guns, enumerated in this section must be reasonable in extent and be subject to the limitations stipulated below in Article XI.

SEC. 6. In case of a ship propelled wholly by sails, any space, not exceeding $2\frac{1}{2}$ per cent of the gross tonnage, used exclusively for storage of sails shall be deducted.

SEC. 7. Spaces used exclusively for boatswain's stores shall be deducted. The deduction is not, however, to exceed 1 per cent of the gross tonnage in ships of 1,000 tons gross and upwards, nor more than 75 tons in any ship however large. In vessels from 500 to 1,000 tons gross the limit is fixed at 10 tons and in vessels from 150 to 500 tons at not more than 2 per cent of the gross tonnage. In vessels under 150 tons at not more than 3 tons.

SEC. 8. The space occupied by donkey engine and boiler shall be deducted if the donkey engine and boiler are connected with the main pumps of the ship, or if they are located in a permanently covered or closed-in structure on or above the upper deck.

SEC. 9. Passages and passageways shall be deducted if they serve deducted spaces exclusively for the officers and crew.

SEC. 10. Water-ballast spaces, other than spaces in the vessel's double bottom, shall be deducted if they are adapted only for water ballast, have only ordinary man-holes for access and are not available for the carriage of cargo, stores, or fuel. If used to carry oil or other fuel, these spaces shall be regarded as part of the vessel's fuel space and shall not be subject to separate deduction.

The marking and use of exempted spaces shall be according to national laws.

ART. XI. Each of the spaces enumerated in Article X, sections 1 to 10, unless otherwise specifically stated, shall be subject to such conditions and requirements as to marking or designation and use or purpose as are contained in the navigation or registry laws of the several countries, but no space, other than fuel spaces deducted under Article XIII of these rules, shall be deducted unless the use to which it is to be exclusively devoted has been appropriately designated by official marking. In no case, however, shall an arbitrary maximum limit be fixed to the aggregate deduction made under Article X.

(B) DEDUCTIONS FOR VESSELS PROPELLED BY ENGINES.

ART. XII. The net or register tonnage upon which tolls and other charges based upon tonnage shall be paid by *vessels* of commerce, Army and Navy transports, colliers, supply ships, and hospital ships, as defined in Article I, *propelled by engines*, for passage through the Panama Canal, shall be the tonnage remaining after the following deductions have been made from the gross tonnage. One hundred cubic feet, or 2.83 cubic meters, shall constitute 1 gross or net ton. Vessels propelled partly by sails and partly by engines shall be classed as "vessels propelled by engines:"

Deductions from gross tonnage allowed vessels propelled by engines.

SECTION 1. The spaces specified above in Article X shall be deducted from the space included in gross tonnage to ascertain net tonnage in the case of vessels propelled by engines as in the case of vessels not propelled by engines.

SEC. 2. The space occupied by the engines, boilers, coal bunkers, fuel-oil tanks, double-bottom fuel and feed-water compartments, shaft trunks of vessels with screw propellers, spaces, within a closed-in side-to-side erection, that are framed in around the funnels or that are required for the introduction of light and air to the engine room to the extent that the framed-in spaces around the funnels and the light and air casings are located below the deck or covering of the first or lowest tier of such erections, if any, on the upper deck, as defined in Article IV, section 3, and are contained in closed-in side-to-side erections, spaces necessary for the proper working of the engines, and spaces occupied by the donkey engine and boiler when situated within the boundary of the engine room or within the light and air casings above the engine room and when used in connection with the main machinery for propelling the vessel. When the shafts of screw propellers pass through open spaces not inclosed within tunnels, the spaces allowed in lieu of the tunnels must be of reasonable dimensions suitable for the vessel in question. When any portion of the engine or boiler rooms is occupied by a tank for fresh water, the space thus taken up shall not be deducted.

Donkey-engine and boiler spaces, when deducted according to Article XIV below, shall not be made a separate deduction.

The portion of the framed-in spaces around the funnels and of the light and air casings that extend above the deck or covering of the first or lowest tier of side-to-side erections, if any, on the upper deck, as defined in Article IV, section 3, and surrounding the said space or spaces are exempted from measurement and form no part of the space deducted under this section.

SEC. 3. The deductions made for propelling power, including all those provided for in section 2 of this article, shall in no case exceed 50 per cent of the gross tonnage, except in case of tugs employed exclusively as tugs. In other respects the spaces enumerated in section 2 shall, except as otherwise specifically stated, be subject to the requirements as to designation or marking and use or purpose contained in the navigation or registry laws of the several countries.

SEC. 4. The deductions made for propelling power provided for in section 2 of this article shall be made according to the provisions of Article XIII or of Article XIV, *as the owner of the vessel may elect.*

SEC. 5. Double-bottom compartments that are set aside to be used exclusively for the stowage of feed water for the ship's boilers shall be deducted.

Propelling power deduction for vessels with bunkers having movable partitions, or having fuel-oil compartments that may be used to stow cargo or stores.

ART. XIII. In ships that do not have fixed bunkers, but transverse bunkers with movable partitions, with or without lateral bunkers, and in ships with fuel tanks or double-bottom fuel compartments which may be used to stow cargo or stores, measure the space occupied by the engine rooms, and add to it for vessels with screw propellers 75 per cent and for vessels with paddle wheels 50 per cent of such space.

By the space occupied by the engine rooms is to be understood that occupied by the engine room itself and the boiler room, together with the spaces strictly required for the working of the engines and boilers, with the addition of the spaces taken up by shaft trunks (in vessels with screw propellers), the spaces which inclose the funnels and the casings necessary for the admission of light and air into the engine room to the extent that such spaces are located below the upper deck or below a deck with openings (usually designated as tonnage openings) which may be so closed as to permit the carriage of cargo or stores under the deck or a portion thereof, and donkey-engine and boiler spaces when the donkey engine and boiler are situated within the boundary of the main engine room or of the light and air casing above it and when they are used in connection with the main machinery for propelling the vessel. When the shafts of screw propellers pass through open spaces not inclosed within tunnels, the spaces allowed in lieu of tunnels must be of reasonable dimensions suitable for the vessel in question. When a portion of the space within the boundary of the engine or boiler rooms is occupied by a tank or tanks for fuel oil or fresh water, the space considered to be within the engine room shall be reduced by the space taken up by the tank or tanks for fuel oil or fresh water.

The cubical contents of the above-named spaces occupied by the engine room shall be ascertained in the following manner: Measure the mean depth of the space occupied by the engines and boilers from its crown to the ceiling at the limber strake; measure also three, or, if necessary, more than three, breadths of the space at the middle of its depth, taking one of such measurements at each end and another at the middle of the length; take the mean of such breadths; measure also the mean length of the space between the foremost and aftermost bulkheads or limits of its length, excluding such parts, if any, as are not actually occupied by or required for the proper working of the engines and boilers. Multiply together these three dimensions of length, breadth, and depth, and the product will be the cubical contents of the space below the crown. Then, by multiplying together the length, breadth, and depth, find the cubical contents of the space or spaces, if any, which are framed in for the machinery, for inclosing the funnels, or for the admission of light and air, and which are located between the crown of the engine room and the uppermost deck or covering of the first or lowest tier of side-to-side erections, if any, on the upper deck, as defined in Art. IV, section 3. Add such contents, as well as those of the space occupied by the shaft trunk and by any donkey engine and boiler located within the boundary of the engine room or of the light and air casing above the engine room and used in connection with the main engines for propelling the ship, to the cubical contents of the space below the crown of the engine room; divide the sum by 100 or by 2.83, according as the measurements are taken in feet or meters, and the result shall be deemed to be the tonnage of the engine and boiler room and shall be the tonnage taken as the basis for calculating the deduction for propelling power.

If in any ship in which the space for propelling power is to be measured the engines and boilers are in separate compartments, the contents of each compartment shall be measured separately in like manner, according to the above method; and the sum of the tonnage of the spaces included in the several compartments shall be deemed to be the tonnage of the engine and boiler rooms, and shall be the tonnage taken as the basis for calculating the deduction for propelling power.

Propelling power deduction for vessels with fixed bunkers, or having fuel-oil compartments that can not be used to store cargo or stores.

ART. XIV. When vessels are fitted with fixed coal bunkers or with fuel-oil tanks or double-bottom fuel compartments which can not be used to stow cargo or stores, and when such bunkers, tanks, and fuel compartments have been certified by official marking to be spaces for the vessel's fuel, the deduction for propelling power may either be in accordance with the provisions of Article XIII above, or by deducting the actual tonnage of the spaces enumerated in Art. XII, Sec. 2 as measured in accordance with the following provisions, as the owner of the vessel may elect: Measure

the mean length of the engine and boiler room, including the coal bunkers. Ascertain the area of three transverse sections of the ship (as set forth in the rules given in Articles VIII or IX for the calculation of the gross tonnage) to the deck which covers the engine. One of these three sections must pass through the middle of the aforesaid length, and the two others through the two extremities. Add to the sum of the two extreme sections four times the middle one, and multiply the sum thus obtained by the third of the distance between the sections. This product divided by 100 if the measurements are taken in English feet, or by 2.83 if they are taken in meters, gives the tonnage of the space measured. If the engines, boilers, and bunkers are in separate compartments, measure each compartment, as above set forth, and add together the results of the several measurements. The bunkers measured for fuel deduction shall include only those bunkers that are absolutely permanent, from which the coal can be trimmed directly into the engine room or stokehole, and into which access can be obtained only through the ordinary coal chutes on deck and from doors opening into the engine room or stokehole. Thwartship bunkers that can be in any way extended are not to be included in the measurements for deductions. When any portion of the engine or boiler rooms is occupied by a tank for fresh water, the space considered to be within the engine and boiler rooms shall be reduced by the space taken up by the tank for fresh water.

The contents of the shaft trunk shall be measured by ascertaining, and multiplying together, the mean length, breadth, and height. The product divided by 100, or 2.83, according as the measurements are taken in English feet or in meters, gives the tonnage of such space. When the shafts of screw propellers pass through open spaces not inclosed within tunnels, the spaces allowed in lieu of tunnels must be of reasonable dimensions suitable for the vessel in question.

The tonnage of the following spaces below the deck or covering of the first or lowest tier of side-to-side erections, if any, on the upper deck, as defined by Art. IV, section 3, is ascertained by the same method, viz: (a) The spaces framed in around the funnels. (b) The spaces required for the admission of light and air into the engine room. (c) The spaces, if any, necessary for the proper working of the engines. (d) Spaces occupied by the donkey engine and boiler when used in connection with the main engines for propelling the ship and when situated within the boundary of the engine room or of the casing above the engine room. (e) Fuel-oil tanks and double-bottom compartments fitted for the stowage of fuel oil.

No space may be deducted unless included in gross tonnage.

ART. XV. Under no circumstances shall any space which has not been included in the gross tonnage be deducted from gross tonnage.

Deducted spaces, if used, must be added to net tonnage.

The use of the whole or any portion of a deducted space, other than fuel spaces deducted under Article XIII, to stow cargo of any kind or stores other than boat-swain's stores, or to provide passenger accommodations, shall be evidence that the entire space thus wholly or partially occupied is a part of the actual earning capacity of the ship and the entire space shall be added to, and become a permanent part of, the net tonnage upon which Panama Canal tolls shall be collected.

Officials that may measure vessels and issue certificates.

ART. XVI. Only such officials as are authorized in the several foreign countries and in the United States to measure vessels and to issue tonnage certificates for purposes of national registry, and such other officials as are authorized by the President of the United States, or by those acting for him, to measure vessels and to issue Panama Canal tonnage certificates, shall have authority to measure vessels for Panama navigation or to issue Panama tonnage certificates.

Tonnage certificates issued under these rules may be corrected by officials at the Panama Canal.

ART. XVII. Tonnage certificates presented at the Panama Canal shall be subject to correction by the official or officials authorized by the President of the United States, or by those acting for him, to administer these measurement rules, in so far as may be necessary to make the certificates conform to these rules.

Panama Canal tonnage certificates.

ART. XVIII. The Panama Canal tonnage certificates issued by the measurement authorities of the United States and the several foreign countries shall correspond in substance and form to the sample certificate appended to these rules. Blank certificates in English will be furnished by the Secretary of War or the Governor of the Panama Canal upon request of the measurement authorities of foreign countries. The measurement authorities of any foreign country may also provide themselves with Panama Canal measurement certificates printed in English or in the language of the foreign country, provided such certificates strictly correspond in substance and form to the sample certificate appended to these rules.

RULES APPLYING TO VESSELS OF WAR, OTHER THAN ARMY AND NAVY TRANSPORTS,
COLLIERS, SUPPLY SHIPS, AND HOSPITAL SHIPS.

Tolls upon warships shall be levied upon actual displacement upon arrival at canal.

ART. XIX. The toll on warships, other than Army and Navy transports, colliers, supply ships, and hospital ships, shall be based upon their tonnage of actual displacement at the time of their application for passage through the canal. The displacement tonnage of such warships shall be their displacement before the vessels have taken on such coal, fuel oil, stores, or supplies as may be purchased and taken on board after arrival at the canal for transit through the same.

"Warships" defined.

ART. XX. "Warships" in the meaning of Articles XIX to XXIV shall be considered to be all vessels of war, other than Army and Navy transports, colliers, hospital ships, and supply ships, as defined in Article I. Warships are vessels of Government ownership that are being employed by their owners for military or naval purposes.

For determination of draft, warships to anchor at station designated by Governor of Panama Canal.

ART. XXI. Every warship, other than Army and Navy transports, colliers, supply ships, and hospital ships (as defined in Art. I) upon applying for passage through the Panama Canal shall, in order to facilitate the ascertainment of its mean draft, be anchored or placed at such station or location as shall be designated by the Governor of the Panama Canal or by the officials authorized to act for him.

Commander of each warship to exhibit vessel's displacement scale and curves.

ART. XXII. The commander of every warship, other than Army and Navy transports, colliers, supply ships, and hospital ships (as defined in Art. I), applying for passage through the Panama Canal shall exhibit for examination by the Governor of the Panama Canal or by the officials authorized to act for the Governor of the Panama Canal an official document containing the vessel's curve of displacement, its curves for addition to displacement for change of trim, and a scale so arranged that the displacement at any given mean draft is shown. Such document or documents shall be issued and be certified as correct by competent authorities of the Government to which the vessel belongs.

Actual displacement to be determined, and to be expressed in tons of 2,240 pounds.

ART. XXIII. The actual displacement of warships shall be determined from their official displacement scale and curves, and shall be expressed in tons of 2,240 pounds. Should the displacement scale and curves of a warship show or state the vessel's displacement tonnage in metric tons of 2,204.62 pounds, the tonnage so expressed shall be multiplied by 0.9842 for the purpose of converting the tonnage into tons of 2,240 pounds.

Rule for determining displacement of a warship not supplied with displacement scale and curves.

ART. XXIV. Should any warship, other than Army and Navy transports, colliers, supply ships, and hospital ships (as defined in Article I) apply for passage through the Panama Canal and, for reasons satisfactory to the Governor of the Panama Canal, not

have on board the duly certified document or documents specified in Article XXII, the Governor of the Panama Canal, or the officials authorized to act for him, shall then determine the displacement of the vessel, using such reliable data as may be available, or by taking such dimensions of the vessel and using such approximate methods as may be considered necessary and practicable. The displacement tonnage so determined shall be considered to be the displacement of the vessel.

PANAMA CANAL TONNAGE CERTIFICATE FOR THE SHIP _____.

Name of ship.	Official number or signal.	Port of registry.	Tonnage on certificate of national registry.		Register length.	Register breadth.	Register depth.
			Gross.	Net.			

Details of Panama Canal gross tonnage.

	Tons of 100 cubic feet.	Cubic feet or cubic meters.	Tons of 100 cubic feet.
The spaces measured for gross tonnage in this ship comprise the following and no others, viz:			
1. Space or spaces under the tonnage deck, viz:			
(a) Space between tonnage deck and double bottom.....			
(b) Double-bottom compartments available for fuel, cargo, feed-water, or stores.....			
Total space under tonnage deck.....			
2. Space or spaces between the tonnage deck and uppermost full length deck.....			
	Tons of 100 cubic feet.		
3. Closed-in spaces under or in permanent constructions on or above the uppermost full length deck, viz:			
(a) Forecastle.....			
(b) Bridge space.....			
(c) Poop.....			
(d) Break or breaks.....			
(e) Turret space.....			
(f) Trunk space.....			
(g) Round houses..... tons, .. tons, .. tons, .. tons, .. tons, .. tons			
" " tons, .. tons, .. tons, .. tons, .. tons, .. tons			
(h) Side houses..... tons, .. tons, .. tons, .. tons, .. tons, .. tons			
" " tons, .. tons, .. tons, .. tons, .. tons, .. tons			
(i) Companion house or companionway (dimensions and tonnage of part used as smoking room or for other special purposes).....			
(j) Passageways serving measured spaces.....			
(k) Cookhouses, galleys, bakeries, and condenser spaces.....			
(l) Lavatories, water-closets, latrines, privies, toilets, wash and bath rooms.....			
(m) Wheelhouses, chart house, house for donkey engine and boiler, spaces for anchor gear, steering gear and capstan, lookout houses, and other closed-in spaces used in working the ship.....			
(n) Sail room.....			
(o) Boatswain's stores.....			
(p) Hatchways..... tons, .. tons, .. tons, .. tons, .. tons, .. tons			
" " tons, .. tons, .. tons, .. tons, .. tons, .. tons			
Excess above one-half per cent of the gross tonnage as figured above.....			
Total closed-in spaces on or above the uppermost full length deck.....			
Panama Canal gross tonnage*.....			

* For spaces not included in gross and net tonnage, see page 4 of this certificate.

Deductions from gross tonnage.*

	Tons of 100 cubic feet.	Cubic feet or cubic meters.	Tons of 100 cubic feet.
Or (2) Danube rule as defined in Articles XII and XIII:			
(a) Engine room as measured (Tonnage below deck....)			
(as defined in Article XIII) (Tonnage between decks.)			
(b) In a vessel with screw propellers+75 per cent of engine room as measured.			
(c) In a vessel with paddle wheels+50 per cent of engine room as measured.			
Total deduction for propelling power. (Limited except for tugs to 50 per cent of gross tonnage)			
Panama Canal net tonnage, power deduction by Danube rule (Arts. XII and XIII)			

Spaces not included in gross tonnage.

[Information must be given concerning all spaces exempted from measurement.]

1. Exemptions under Article IV, Sec. 1 (a)—(Name or otherwise identify).....
2. Exemptions under Article IV, Sec. 1 (b)—(Name and state separately the dimensions and tonnage of the parts exempted):
Poop.....
Forecastle.....
Bridge.....
.....
.....
3. Exemptions under Article IV, Sec. 1 (c)—(Name and state separately the dimensions and tonnage of the parts exempted):
Poop.....
Forecastle.....
Bridge.....
.....
.....
4. Exemptions under Article IV, Sec. 2.—(Name the deck and state separately the dimensions and tonnage of the parts exempted):
.....
.....
5. Exemptions under Article IV, Sec. 3.—(Name spaces exempted):
Spaces framed in round funnels.....
Spaces framed in round light and air casings.....
6. Exemptions under Article IV, Sec. 4.—(Name or give number of double-bottom compartments exempted):
.....
.....
7. Exemptions under Article IV, Sec. 6.—(Name or otherwise identify spaces exempted):
.....
.....
8. Exemptions under Article IV, Sec. 7.—(Name or otherwise identify spaces exempted):
.....
.....
9. Particulars as to hatchways (Article IV, Sec. 5) need not be restated if fully given on second page of this certificate.
.....
10. State any other particulars of exempted spaces:
This is to certify that the ship above named has been measured in
(Nationality)
accordance with the Rules for the Measurement of Vessels for the Panama Canal, and
that the particulars of tonnage contained in this Certificate are correct.
Given under my hand at, this, 191.....
..... (Signature.)
..... (Official position.)

EXECUTIVE ORDER.

By direction of the President, it is ordered that the total compensation of Professor Emory R. Johnson, who was appointed a Special Commissioner by Executive Order, dated September 1, 1911, is hereby fixed at Twenty-five Thousand, Three Hundred Dollars (\$25,300), from which shall be deducted any payments on account of actual expenses and per diem heretofore made to him under the provisions of the Executive Order of September 1, 1911, such compensation covering the period from September 1, 1911, to October 4, 1913, inclusive.

The Isthmian Canal Commission is directed to provide the funds needed in the execution of this order.

LINDLEY M. GARRISON,
Secretary of War.

WAR DEPARTMENT,
January 20, 1914.

EXECUTIVE ORDER.

To Prevent the Corrupt Influencing of Agents, Employees or Servants.

By virtue of the authority vested in me I hereby establish the following Executive order for the Canal Zone:

Section 1. It shall be unlawful for any person to give, offer or promise to an agent, employee or servant, any gift or gratuity whatever without the knowledge and consent of the principal, employer or master of such agent, employee or servant with intent to influence his action in relation to the business of his principal, employer, or master; or for any agent, employee or servant, without the knowledge and consent of his principal, employer or master, to request or accept a gift, or gratuity, or the promise of any gift or gratuity whatever beneficial to himself, under an agreement or with an understanding that he shall act in any particular manner in respect to the business of his principal, employer, or master; or for any agent, employee or servant authorized to procure materials, supplies or other articles either by purchase or contract for his principal, employer or master, or to employ servants or labor for his principal, employer or master, to request or accept or agree to accept, for himself or another, directly or indirectly, a commission, discount or bonus from the person who makes the sale or contract, or furnishes such materials, supplies or articles or from the person who renders such service or labor; or for any person to give or offer to such agent, employee, or servant such commission, discount or bonus.

A violation of any of the provisions of this order shall be punished by a fine of not less than ten dollars nor more than five hundred dollars, or by imprisonment in jail for not more than one year, or both such fine and imprisonment in the discretion of the Court.

Section 2. This order shall take effect thirty days from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
21 January, 1914.

[No. 1830.]

EXECUTIVE ORDER.

To Prevent Fire-Hunting at night, and Hunting by Means of a Spring or Trap, and to repeal the Executive Order of September 8, 1909.

By virtue of the authority vested in me I hereby establish the following order for the Canal Zone.

Section 1. Every person who shall hunt at night, between the hours of sunset and sunrise, with the aid or use of a lantern, torch, bonfire, or other artificial light, or who shall hunt by the use of a gun or other firearm intended to be discharged by an animal or bird, by means of a spring or trap, or other similar mechanical device, shall be guilty of a misdemeanor.

The penalties imposed by this Order shall be in addition to the punishments authorized by the law against carrying arms without a permit.

Sec. 2. The Executive Order of September 8, 1909, amending Section 454 of the Penal Code of the Canal Zone is hereby repealed.

Sec. 3. This order shall take effect thirty days from and after its publication in the Canal Record.

WOODROW WILSON

THE WHITE HOUSE,
27 January, 1914.

[No. 1884.]

EXECUTIVE ORDER.

To Establish a Permanent Organization for the Panama Canal.

By virtue of the authority vested in me, I hereby enact the following order, creating a permanent organization for the Panama Canal, under the Act of Congress "To provide for the opening, maintenance, protection and operation of the Panama Canal and the sanitation and government of the Canal Zone," approved August 24, 1912.

SECTION 1. The organization for the completion, maintenance, operation, government and sanitation of the Panama Canal and its adjuncts and the government of the Canal Zone shall consist of the following departments, offices and agencies, and such others as may be established by the Governor of the Panama Canal on the Isthmus or elsewhere with the approval of the President, all to be under the direction of the Governor, subject to the supervision of the Secretary of War.

DEPARTMENT OF OPERATION AND MAINTENANCE.

There shall be a Department of Operation and Maintenance under the immediate supervision and direction of the Governor of the Panama Canal. This Department shall be charged with the construction of the Canal and with its operation and maintenance when completed, including all matters relating to traffic of the Canal and its adjuncts, and the operation and maintenance of beacons, lights and lighthouses; the supervision of ports and waterways, including pilotage; the admeasuring and inspecting of vessels, including hulls and boilers; the operation and maintenance of the Panama Railroad upon the Isthmus, including telephone and telegraph systems; the operation of locks, coaling plants, shops, dry-docks and wharves; office engineering, including meteorology and hydrography; the construction of buildings and sanitary and municipal engineering, including the construction and maintenance of drainage ditches, streets, roads and bridges.

PURCHASING DEPARTMENT.

There shall be a Purchasing Department under the supervision and direction of the Governor. This department shall be charged with the purchase of all supplies, machinery or necessary plant.

SUPPLY DEPARTMENT.

There shall be a Supply Department, under the supervision and direction of the Chief Quartermaster. This department shall store and distribute all material and supplies for use of the Panama Canal and of its employees; and for other departments of the Government on the Isthmus and their employees; and for vessels of the United States and for other vessels, when required. The Supply Department shall operate commissaries, hotels and messes; shall be in charge of the maintenance of buildings, the assignment of quarters and the care of grounds; shall recruit and distribute unskilled labor; and shall have charge of the necessary animal transportation.

ACCOUNTING DEPARTMENT.

There shall be an Accounting Department under the supervision and direction of the Auditor, with an assistant in the United States. The duties of the department shall include all general bookkeeping, auditing and accounting, both for money and property, costkeeping, the examination of payrolls and vouchers, the inspection of time books and of money and property accounts, the preparation of statistical data, and the administrative examination of such accounts as are required to be submitted to the United States Treasury Department; and the collection, custody and disbursement of funds for the Panama Canal and the Canal Zone. These same duties shall be

performed for the Panama Railroad Company on the Isthmus when not inconsistent with the charter and by-laws of that Company. The department shall be charged with the handling of claims for compensation on account of personal injuries and of claims for damages to vessels. Within the limits fixed by law, the duties and financial responsibilities of the officers and employees charged with the receipt, custody, disbursement, auditing and accounting for funds and property shall be prescribed in regulations issued by the Governor, with the approval of the President. The Auditor shall maintain such a system of bookkeeping as will enable him to furnish at any time full, complete and correct information in regard to the status of appropriations made by Congress, the status of all other funds, and the amounts of net profits on all operations, which are to be covered into the Treasury as required by the Panama Canal Act.

HEALTH DEPARTMENT.

There shall be a Health Department under the supervision and direction of the Chief Health Officer. This department shall be charged with all matters relating to maritime sanitation and quarantine in the ports and waters of the Canal Zone and in the harbors of the cities of Panama and Colon, and with land sanitation in the Canal Zone, and sanitary matters in said cities in conformity with the Canal Treaty between the United States and the Republic of Panama and existing agreements between the two governments thereunder, and all matters relating to hospitals and charities.

EXECUTIVE SECRETARY.

There shall be an Executive Secretary who, under the direction of the Governor of the Panama Canal, shall be charged with the supervision of all matters relating to the keeping of time of employees; to postoffices, customs, taxes and excises, excepting the collection thereof; police and prisons; fire protection; land office; schools, clubs and law library; the custody of files and records; and the administration of estates of deceased and insane employees. He shall, in person or through one of his assistants, perform the duties of a Shipping Commissioner. He shall conduct all correspondence and communications between the authorities of the Canal Zone and the Government of the Republic of Panama and such other correspondence as may be given him in charge by the Governor. He shall have charge of the seal of the Government of the Canal Zone and shall attest such acts of the Government as are required by law to be performed and done under the seal.

The duties herein prescribed for the foregoing departments, offices and agencies will be assigned to divisions or bureaus thereunder by the Governor of the Panama Canal, as the necessities therefor arise. Each of the foregoing departments shall discharge such further duties as may be assigned to it from time to time by the Governor; and the Governor, with the approval of the President, may transfer from time to time specific duties from one department to another.

SECTION 2. The organization provided for in Section 1 shall be, in general, in accordance with the outline chart accompanying the memorandum of Jan. 27, 1914, entitled "Memorandum to accompany Executive Order of Jan. 27, 1914, providing for a permanent organization for the Panama Canal", and officers from certain departments shall be detailed in accordance with that memorandum.

SECTION 3. This order shall take effect from and after the 1st day of April, 1914, from which date the Isthmian Canal Commission, together with the present organization for the Panama Canal and the Canal Zone, shall cease to exist, in accordance with the terms of the above-mentioned Act of Congress.

WOODROW WILSON

THE WHITE HOUSE,
January 27, 1914.

[No. 1885.]

[Memorandum to accompany Executive Order of January 27, 1914, providing for a permanent organization for the Panama Canal.]

In construing and carrying out the foregoing order, I direct that it be done with the following considerations in view:—

I have deemed it advisable for reasons of efficiency, economy and good administration to have all the activities connected with the Panama Canal under the supervision of one Cabinet Officer.

The troops which will be stationed on the Canal Zone for the protection of the Panama Canal are under the Secretary of War; the Panama Canal Act provides that in time of war an Officer of the Army shall upon the order of the President have exclusive authority over the operation of the Panama Canal and the Government of the

Canal Zone; the construction of the Canal has been successfully carried on under the supervision of the Secretary of War; the logical conclusion is, therefore, that the supervision of the operations of the Panama Canal under the permanent organization should be under the Secretary of War.

It is directed that officers shall be detailed for certain duties from the several departments as follows:

As Engineer of Maintenance, an Officer of the Corps of Engineers, U. S. Army, who shall act as Governor in the absence or disability of the Governor of the Panama Canal.

As Superintendent of Transportation, an Officer of the U. S. Navy.

As Electrical Engineer, an Officer of the Corps of Engineers, U. S. Army.

As Captains of the Terminal Ports, Officers of the U. S. Navy.

As Superintendent of Shops and Dry Docks, a Naval Constructor, U. S. Navy.

As Chief Health Officer, an Officer of the Medical Corps, U. S. Army.

As Superintendent of Hospitals, an Officer of the Medical Corps, U. S. Army.

As Chief Officer of the Quarantine Division, an Officer of the U. S. Bureau of the Public Health.

As Chief Quartermaster, an Officer of the Quartermaster Corps, U. S. Army.

The organization is to be in general accordance with the chart accompanying this memorandum, except that all of the various divisions and sub-divisions need not be established until in the opinion of the Governor it is desirable to do so, the organization being expanded gradually as the necessities of the work require.

WOODROW WILSON

JANUARY 27, 1914.

EXECUTIVE ORDER.

Providing Conditions of Employment for the Permanent Force for the Panama Canal.

By virtue of the authority vested in me by law, it is hereby ordered that the general conditions of employment governing employees on the Isthmus of Panama, necessary for the completion, care, management, maintenance, sanitation, government and operation of the Panama Canal, the Canal Zone, the Panama Railroad, and other adjuncts, shall be as follows:

APPOINTMENT AND COMPENSATION.

1. The salaries or compensation of employees shall in no instance exceed by more than twenty-five per centum the salaries or compensation paid for the same or similar services to persons employed by the Government in Continental United States, as determined by the Governor of the Panama Canal.

2. Service must be satisfactory to the head of the department in which employed, and employees are subject to the regulations of the Governor.

3. The compensation and conditions of employment of persons employed in the United States will be specified in provisional appointments. The compensation of such persons will begin upon date of embarkation at port of departure from the United States, and they will be granted free transportation from port of departure, including meals on the steamer, but no compensation or expenses for the journey to the port; but former employees from the United States whose next preceding service with the Panama Canal was less than one year shall be paid only from date of entry into service on the Isthmus, and will be allowed only such reduced rates of transportation to the Isthmus as may be available for Government employees. Employees appointed at an hourly rate will be paid for the period of transit to the Isthmus on the basis of an eight hour day exclusive of Sundays. Except in case of discharge or other separation from the service beyond the employee's control, payment of salary from date of embarkation to date of arrival on the Isthmus will not be made unless service on the Isthmus continues for thirty days.

4. All officers and employees in the service of the Panama Canal except those who are to perform the duties of clerk, bookkeeper, stenographer, typewriter, surgeon, physician, trained nurse, or draftsman, shall be exempt from examination under Civil Service rules, and appointments to clerical positions on the Isthmus of Panama, paying \$75.00 per month or less may also be made without examination. Officers and employees now in the service of the Panama Railroad Company on the Isthmus may be transferred to and retained in the service of the Panama Canal without examination, whenever any work now performed independently by the Panama Railroad is consolidated with similar work performed by the Panama Canal.

5. When employees in the present organization are transferred to the permanent organization, they shall retain their seniority as regards questions of Civil Service, quarters, and other privileges or considerations; provided, however, that the seniority granted to employees by this order shall not be operative in any case so as to form any claim involving the payment of funds of the United States.

6. All employees who receive over \$75.00 per month or over 40¢ per hour must be citizens of the United States or the Republic of Panama, and such citizens will be given preference for employment in all grades. Aliens may not be employed in such grades unless

(a) they have occupied similar positions during the construction of the Canal for two years or more, or

(b) in case of emergency, in which latter case they must be replaced by citizens of the United States or Republic of Panama as early as practicable.

7. The Governor shall prescribe regulations, when not otherwise fixed in this order, setting forth the qualifications necessary for appointment of the various classes of employees, including physical fitness for work on the Isthmus. The age limit shall in all cases be under 45 years, but the Governor may waive this limit when in his judgment such action is for the good of the service.

8. All appointments shall be made by the Governor of the Panama Canal, or by his authority, except the district judge, district attorney, marshal, clerk of district court and his assistant.

9. Assignment to duty is vested in the respective heads of the departments, and employees will be expected to perform such duties as may properly be assigned to them. The Governor may discharge an employee at any time for cause, and terminate a provisional appointment when the exigencies of the service so require.

10. The Government reserves the right to pay in any money the value or parity of which is guaranteed by the United States.

11. Employees whose salaries are fixed on a monthly or annual basis will receive no pay for overtime work.

12. Employees above the grade of laborer, appointed with rates of pay per hour or per day, will not be employed over eight hours in any one calendar day, except in case of emergency. The time such employees work over eight hours in one calendar day, and time worked on Sundays and regularly authorized holidays, including January 1st, February 22nd, May 30th, July 4th, Labor Day, Thanksgiving Day, and December 25th, shall be considered overtime for which time and one-half will be allowed. Such employees who work on the days prior and subsequent to the holidays specifically named above will be allowed their regular pay for eight hours for such days, in addition to pay for any work performed.

13. An employee whose compensation while on duty carries with it subsistence will not be entitled to same or commutation thereof while on leave of absence, and no commutation of quarters shall be paid.

TRANSPORTATION.

14. Employees and dependent members of their families will be granted the regular Government rate upon commercial steamship lines with which arrangements for such rates can be made. While the United States operates a steamship line, either directly or through the Panama Railroad Company, employees and the dependent members of their families will be granted transportation at the same rates and under the same conditions as are at present in effect. The rates and conditions are subject to change at any time in the discretion of the Governor.

15. After three years service, employees who are citizens of the United States will be entitled to free transportation for themselves only, on termination of service, to any port of the United States, except that when such transportation costs the Government more than \$40.00 the employee must pay the excess.

16. Employees on the gold roll will be granted one complimentary round-trip pass on the Panama Railroad each calendar month. Mileage books for use of such employees and dependent members of their families or relatives temporarily residing with them, will be furnished at one-half regular tariff rates.

QUARTERS.

17. Where practicable, such bachelor quarters on the Isthmus as may be available from time to time will be assigned all employees desiring them. Family quarters, when available, will be assigned under such rules as may be prescribed by the Governor. A charge will be made for rent, fuel, and electric current at such time and in accordance with such regulations as the President may hereafter establish.

MEDICAL CARE.

18. Employees injured will be compensated in accordance with such regulations as are prescribed by law.

19. All employees in cases of illness or injury will receive free medical care and attendance in the hospitals, except in cases of alcoholism or venereal disease. If medical attendance is furnished in quarters, a charge may be made under regulations to be prescribed by the Governor. Employees will be charged for medical care and attendance furnished members of their families at the hospitals and at their quarters at such rates and under such regulations as may be prescribed by the Governor.

LEAVE REGULATIONS.

20. All employees who are citizens of the United States, and aliens whose compensation is more than \$75.00 per month or 40¢ per hour, shall be entitled to leave privileges.

21. Leave will be divided into three classes, viz: (1) annual leave, (2) cumulative leave, and (3) travel leave.

ANNUAL LEAVE.

22. Twenty-four days annual leave will be allowed each employee for each year after entry into service and, if not granted prior to the close of the year, is forfeited and may not be accumulated, except that any annual leave remaining to an employee's credit in a year in which he is granted cumulative leave may be added to the cumulative leave if taken within two months after the close of his service year.

23. The service year shall date from the day on which an employee's pay in the permanent organization begins.

24. Absences of one-half day or more, when regularly authorized, will be charged against annual leave; also absences on account of illness or injury, upon the certificate of an authorized physician in the service of the Panama Canal, except that in the following classes of cases no payment shall be made for time lost, but the time shall be charged against the annual leave:

(a) Illness due to the fault of the employee, as venereal disease and alcoholism.

(b) Injury due to the employee's wilful intention to bring about the injury or death of himself or another.

(c) Elective surgical operations to relieve conditions existing prior to service on the Isthmus.

25. In the case of hourly or per diem employees annual leave on account of sickness or injury shall be based upon a day of eight hours.

26. Not more than fourteen days annual leave may be taken during the first six months of a service year. In case of illness or injury in the first six months, to cover which no annual leave remains to the employee's credit, the time lost will be charged against the annual leave remaining for the year, and payment will be made after completing ten months of the service year. After the entire twenty-four days annual leave has been used, additional leave in that service year on account of illness or injury will be deducted from the cumulative leave for that year and when the cumulative leave becomes due the employee will be paid.

27. After exhausting both annual and cumulative leave for the year, additional absence on account of illness or injury will be without pay, except such compensation as may be prescribed by law for employees receiving personal injuries.

CUMULATIVE LEAVE.

28. Thirty days cumulative leave will be allowed each employee paid on a monthly or annual basis for each year of his service, and twenty days to each employee paid on an hourly basis. This leave will be due after completing ten months' service each year and may be taken when the employee's service can be spared. It may be taken annually or left to accumulate to the credit of the employee, provided, however, that leave may not be accumulated for more than three years. If it is not desired to take the entire leave accumulated, the leave earned for the first year, or the first and second years, may be taken, provided that no employee, except at termination of service, may be granted more than ninety days leave with pay at one time. Employees will be paid for cumulative leave at the rate earned when the leave became due at the end of the tenth month of each respective year.

29. In case an employee serves part of a year on the monthly or annual basis and part on the hourly basis, he will be allowed twenty days cumulative leave, except that if he has served eight months or more on the monthly or annual basis during the year he will be granted thirty days cumulative leave.

TRAVEL LEAVE.

30. Employees who travel to points outside the Tropics, when on cumulative leave, will be allowed seven days additional leave (or travel leave) with full pay. Travel leave may be allowed approximately once a year and is not cumulative.

31. Employees will be compensated for travel leave and annual leave taken in conjunction with cumulative leave at the rate earned when cumulative leave last became due.

32. After accumulating leave for three years, an employee ceases to earn additional cumulative leave until he is granted all or part of the cumulative leave already earned, unless he shall enter on cumulative leave within two months after completing the third year, or be ordered by the Governor to defer taking leave for official reasons.

33. When an employee's services are terminated on account of misconduct or unsatisfactory service, any annual leave due and travel leave will be forfeited, and cumulative leave will also be forfeited unless written notification has been given that the employee has accumulated the leave, or the four months period within which the employee may enter on leave has passed. Such written notice must be given by employees as soon as possible after cumulative leave becomes due.

34. When an employee's service is terminated, a cash payment in commutation of leave will be made to him for the number of days' cumulative leave due, plus the annual leave due. In the event of his death his estate will be paid the sum due.

35. Employees must enter on cumulative leave within four months after the date when it becomes due, except when accumulated, or unless otherwise authorized by the Governor.

36. Employees must report from leave within one week after the authorized leave expires or forfeit pay for the leave. In case of unavoidable delay, the Governor will decide whether the circumstances warrant an exception to this rule.

37. No restrictions are placed on the localities where leave may be spent.

38. Any employee transferred from the present force to the permanent operating force will be paid at the time of transfer, in addition to his regular compensation, the amount he would have received in payment for leave had he been separated from the service at the time of transfer.

39. Leave may be taken only at the convenience of heads of departments, who may direct an employee to accumulate his leave if necessary for the conduct of the work.

40. Leave without pay may be granted by the Governor to all employees, including laborers, for such period as may be prescribed by him.

OFFICE HOURS AND HOURS OF LABOR.

41. Office hours and hours of labor will be fixed by the Governor within the limits prescribed by law.

42. This order shall take effect from and after the 1st day of April, 1914.

WOODROW WILSON

THE WHITE HOUSE,
2 February, 1914.

[No. 1888.]

EXECUTIVE ORDER.

To Establish a Washington Office of The Panama Canal, to Provide Temporarily for the Organization, Officials and Employes thereof, and to Continue in Force for the Panama Canal, Rules, Regulations, and Executive Orders which may have been made for the Isthmian Canal Commission.

By virtue of the authority vested in me it is hereby ordered:

SECTION I. That an office of The Panama Canal is established in the City of Washington in the District of Columbia.

SECTION II. That the Washington Office of the Panama Canal shall be the office of general records in the United States, and shall succeed to the custody, care and preservation of all the records and files of the Isthmian Canal Commission, to be retained and preserved in the United States on and after April 1, 1914, and shall also succeed to and become chargeable with all property of every kind and character purchased for the Washington Office of the Isthmian Canal Commission, which is on hand April 1, 1914.

SECTION III. That the Washington Office of The Panama Canal shall be the headquarters and the principal office of the Purchasing Department of The Panama Canal.

The head of the Purchasing Department of The Panama Canal, under the direction of the Governor, shall have administrative control of the Washington Office of The Panama Canal. He shall be subject to orders and supervision of the Chief of Engineers of the U. S. Army to such extent as may be directed by the Secretary of War. He shall be General Purchasing Officer for The Panama Canal, and shall also act as the Chief of the Washington Office of The Panama Canal.

SECTION IV. That until further ordered, the Washington Office of The Panama Canal shall have the same organization as to offices and departments (except the Office of the Assistant Examiner of Accounts and the Disbursing Office) as the Washington Office of the Isthmian Canal Commission shall have on March 31, 1914. The number, class and salaries of officials and employees in each of the offices and departments, except as hereinafter provided, shall be the same as those authorized for the Washington Office of the Isthmian Canal Commission on March 31, 1914, and any change in the salary of any position, or in the number of positions in any office or department, shall be made only as now provided by law. The officers and employees, except as hereinafter provided, shall perform the same class of duties that they may be assigned to on March 31, 1914.

SECTION V. That the Assistant Auditor provided for in Executive Order No. 1885, dated January 27, 1914, shall be appointed April 1, 1914. His salary shall be fixed by the Governor. He shall perform such duties of the Accounting Department to be performed in the United States, as may be assigned to him by the Auditor, and also such other duties of a general nature as may be assigned to him by the Chief of the Washington Office of The Panama Canal.

On and after April 1, 1914, there shall be transferred to the Assistant Auditor, and he shall be charged with the custody, care and preservation of, all records and property of the Disbursing Officer, and of the Assistant Examiner of Accounts of the Isthmian Canal Commission, with which those officers shall be charged on March 31, 1914.

The Chief of the Washington Office may, however, transfer to and place in the custody of the Disbursing Clerk, hereinafter provided for, such of the property and records above described, as he may deem to be essential to enable the Disbursing Clerk to properly perform his duties under this order, but the Disbursing Clerk shall not be permitted, without specific authority from the Chief of Office, to keep a separate set of records and files. He shall be required to rely upon, and consult when necessary, the records and files in the office of the Assistant Auditor, in verifying the legality of claims and accounts submitted to him for payment, or to verify the details of any collection for which he is required to account. Disbursements will be made by the Disbursing Clerk only after examination of the claim or account in the office of the Assistant Auditor.

Such of the officers and employes employed in the office of the Assistant Examiner of Accounts and the Disbursing Office of the Isthmian Canal Commission on March 31, 1914, as the Governor determines to retain, shall be transferred to and employed in the Accounting Department in the United States, and their salaries fixed at such amounts as the Governor deems just and reasonable.

There shall be a Disbursing Clerk for that part of the Accounting Department in the United States, who shall perform similar duties to those that are required to be performed by the Collector and Paymaster on the Isthmus, in so far as there are such duties to be performed in the United States, and shall be subject to the same supervision by the Assistant Auditor, as the Collector and Paymaster on the Isthmus are by the Auditor. He shall give bond in such amount as may be fixed by the Governor, or by his authority.

Such of the officers and employes as are transferred to and employed in the Accounting Department in the United States, shall be distributed between the office of the Assistant Auditor and that of the Disbursing Clerk, respectively, as the needs of the service require. They shall perform such duties as may be assigned to them by proper authority. They shall be subject to similar financial responsibilities, and to the same general rules and regulations that have been prescribed for like officers and employes employed in the Accounting Department on the Isthmus.

It is the purpose of this order, and it shall be so construed, as to require the Assistant Auditor of The Panama Canal to examine all claims and accounts before their payment by the Disbursing Clerk; to carry on all general correspondence in relation to claims and accounts required to be conducted by the Accounting Department in the United States; to prepare all vouchers and certify to the validity of all claims and accounts before they are submitted to the Disbursing Clerk for payment; to furnish to the Disbursing Clerk all necessary data to enable that officer to make reply to any exceptions that may be taken to his account by the Auditor for the War Department; to keep all general records required to be kept in the Accounting Department in the United States; to make all reports as to statistical data required to be sent to the

Auditor on the Isthmus; to give an administrative examination to all accounts of the Disbursing Clerk before they are transmitted to the Auditor; to make an administrative examination of all claims which are to be submitted to the Auditor for direct settlement; to keep a complete record of all collections to be made and all moneys received by the Disbursing Clerk; to certify to the correctness of the Disbursing Clerk's accounts for collections; to see that bills collectible are issued and collections made in all proper cases; to have charge of all general files which are required to be kept by the Accounting Department in the United States; and to perform such other duties as may be assigned to him by the Auditor, or the Chief of the Washington Office.

SECTION VI. That any person holding appointment or employment in or under Washington Office of the Isthmian Canal Commission on March 31, 1914, shall be eligible for appointment to, or employment in a like position in or under the Washington Office of The Panama Canal, created by this order, and all except those employed in the Accounting Department, will be considered to be transferred and appointed to such like position in or under the Washington Office of The Panama Canal, as of April 1, 1914, without further order or appointment. The oath of office shall be taken by all officials and employees of the Washington Office.

SECTION VII. This order shall remain in force as a provisional order only, for the establishment of the Washington Office of The Panama Canal, until an order for the permanent organization of such office shall have been made.

SECTION VIII. All rules, regulations and executive orders, not inconsistent with the provisions of this order and the Executive Orders of January 27, and February 2, 1914, heretofore made for the Isthmian Canal Commission, and applicable to conditions that will exist under these orders, shall be and are hereby continued in full force and effect, as rules, regulations, and executive orders for the government of officers and employes of The Panama Canal and the transaction of the business of The Panama Canal.

WOODROW WILSON

THE WHITE HOUSE, 2 March, 1914.

[No. 1897.]

EXECUTIVE ORDER.

Relating to the Canal Zone Judiciary.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

Section 1. The Balboa Division of the District Court of the Canal Zone, in conformity with the Panama Canal Act, shall include all that part of the Canal Zone which lies within the lines of the 10-mile zone and extends from the south bank of the Chagres River and the shore line of Gatun Lake, 87 feet above mean sea level, to the Pacific Ocean; and the Cristobal Division of said Court shall include all of the territory within the lines of the 10-mile zone, extending from the Balboa Division to the Atlantic Ocean, and the area of Gatun Lake beyond the lines of the 10-mile zone up to the contour line of 100 feet above mean sea level and the islands in said lake; and the peninsulas bordering on said lake which have been taken by the United States for the purposes of the Panama Canal.

Sec. 2. Civil and criminal cases within the original and appellate jurisdiction of the District Court arising in the division of Balboa shall be tried in the town of Balboa, and those arising in the division of Cristobal shall be tried in the town of Cristobal. The Governor of the Panama Canal shall provide a suitable place in each of said towns for the holding of the sessions of the District Court.

Sec. 3. The Canal Zone is hereby divided into two subdivisions to be known as the subdivision of Balboa and the subdivision of Cristobal. The territorial limits of the subdivision of Balboa shall be coterminous with those provided in this Order for the Balboa Division of the District Court, and the territorial limits of the subdivision of Cristobal shall be coterminous with the Cristobal Division of the District Court.

Sec. 4. The town of Balboa shall include the townsite at the Pacific terminus of the Canal of that name, as well as the other settlements within the Balboa subdivision; and the town of Cristobal shall include the townsite of that name as well as all other settlements within the Cristobal subdivision of the Canal Zone.

Sec. 5. There shall be a magistrate and a constable for each of the towns of Balboa and Cristobal to be appointed by the Governor, in conformity with Section 7 of the Panama Canal Act. The said magistrates shall hold court at such places in their respective towns as may be designated by the Governor of the Panama Canal from time to time.

Sec. 6. Appeals in civil and criminal cases are hereby authorized from the judgments and rulings of the Magistrate Courts to the District Court of the Canal Zone in like manner as appeals have been heretofore allowed from the District Courts of the Canal Zone to the Circuit Courts thereof.

Sec. 7. Magistrates and constables appointed for the Magistrate Courts, before assuming office, shall be required to subscribe an oath of office before an officer of the Canal Zone authorized to administer the same, to the effect that they will faithfully and impartially discharge the duties of their respective offices; and the constables of said courts shall be required to execute a bond with two or more good and sufficient sureties, or by a bonding company, to be approved by the Governor, in the sum of One Thousand Dollars, conditioned that the officer executing said bond will faithfully comply with his duties as constable, and will turn over all moneys, properties, and effects coming into his hands by virtue of his office to the persons entitled thereto in accordance with law; and the bond may be sued upon in any court of competent jurisdiction by any person who may be injured by reason of a failure of official duty on the part of the constable, and the bond shall not become void upon the first recovery, but successive suits may be instituted thereon until the full amount thereof is exhausted.

Sec. 8. The rules heretofore governing the District Courts of the Canal Zone and prescribing the duties of the District Judges there, and bailiffs, and those respecting the disposition of fines, costs, forfeitures, and enforcement of judgments in said courts and providing for appeals therefrom to the Circuit Court, shall apply to the Magistrate Courts established by this Order and to the magistrates and constables thereof.

Sec. 9. The District Judge, in selecting jurors to render jury service in the district court, shall choose them from among those residing within the division in which they are called upon to serve as such jurors.

Sec. 10. The rules of evidence, practice, and procedure heretofore established in the Circuit Courts of the Canal Zone, not inconsistent with the provisions of the Panama Canal Act, shall govern in the trial of cases in the District Court of the Canal Zone.

Sec. 11. The District Judge may order a change of venue in any case, civil or criminal, when in his opinion that is necessary to an orderly and due administration of justice, or when for any cause it is not practicable to hold a session in the division where the case was originally instituted; and he may, at his discretion, order a change of venue in any case by consent of the parties. When a change of venue is ordered in any civil or criminal case, the Judge shall state his reasons therefor in the order directing the change of venue.

Sec. 12. Whenever a change of venue has been ordered by the Court, the clerk shall immediately make out a true transcript of all the orders made in said cause, and certify thereto under his official seal, and transmit the same with the original papers in the case to the other division of the District, and the case shall be tried therein as if it had been instituted there originally.

Sec. 13. The Supreme Court of the Canal Zone and the judges thereof shall continue to act after this Order takes effect until the cases and business pending therein have been finally determined and disposed of; but cases tried in any of the Circuit Courts prior to April 1, 1914, shall not be heard in the Supreme Court unless the appeal is perfected and the case docketed in the Supreme Court before May 1, 1914.

Sec. 14. This Order shall take effect from and after April 1, 1914.

WOODROW WILSON.

THE WHITE HOUSE, March 12, 1914.

[1898.]

EXECUTIVE ORDER.

By virtue of the authority vested in me by Section 5 of the Panama Canal Act, approved August 24, 1912, directing the President to "provide a method for the determination and adjustment of all claims arising out of personal injuries to employees thereafter occurring while directly engaged in actual work in connection with the construction, maintenance, operation or sanitation of the Canal, or of the Panama Railroad, or of any auxiliary canals, locks or other works necessary and convenient for the construction, maintenance, operation or sanitation of the Canal, whether such injuries result in death or not, and prescribe a schedule of compensation therefor," I hereby establish the following Order:

Section 1. The United States or the Panama Railroad Company shall pay compensation as hereinafter specified for personal injuries to their respective employees occurring on and after April 1, 1914, while such employees are directly engaged in

actual work in connection with the construction, maintenance, operation or sanitation of the Panama Canal, or of the Panama Railroad, or of any auxiliary canals, locks or other works necessary and convenient for the construction, maintenance, operation or sanitation of the Panama Canal, whether such injuries result in death or not; provided, however, that no compensation shall be paid to any employee for any injury occurring to himself, nor shall any compensation be paid to his legal representatives or other person in the event of his death, if such injury or death occurred to him as the result of an intention upon his part to cause such injury to himself or to cause his own death; and no compensation shall be paid to any employee who is injured as the result of an intention upon his part to cause injury or death to another person, nor shall any compensation be paid to his legal representatives or to any other person in the event of his death, as the result of an intention upon his part to cause injury or death to another person; and provided further, That no compensation shall be paid to any employee for any injury to himself which was brought about by reason of his own intoxication; and similarly, no compensation shall be paid to the legal representatives or to any other person for or on account of the death of any employee when such death was brought about by reason of the intoxication of such employee.

Section 2. Compensation the exclusive remedy. Except as provided in this order, the United States and the Panama Railroad Company shall not be liable for personal injury to or the death of an employee for which compensation is provided in Section 1 hereof.

Section 3. Waiting period. No compensation shall be paid for a period of disability unless such period shall cover seven full consecutive days following the day of the inception of such disability. For any part of the day on which disability on account of injury begins and for the first four days of disability following, no compensation shall be paid at any time except as provided in Sections 9 and 10.

Section 4. Permanent total disability. If the injury results in permanent total disability, compensation shall be paid to the employee, except as provided in Section 16, for a period of eight years. For the first three months of such period, following the fourth entire day of disability, the monthly compensation shall equal 75 per cent of his monthly pay, and for the remainder of the period 50 per cent of his monthly pay.

The following cases shall be included among those held to result in permanent total disability, to-wit:

- The total and irrecoverable loss of sight in both eyes;
- The loss of both feet at or above the ankle;
- The loss of one hand and one foot;
- The loss of both hands at or above the wrist;
- Paralysis of the legs, arms, feet or hands, or an arm and a leg;
- Injury resulting in incurable imbecility or insanity.

Section 5. Temporary Disability. If the injury results in temporary disability, compensation shall be paid to the employee, except as provided in Section 16, until the end of the period for which compensation is payable as fixed below, unless such employee in the opinion of the Governor of the Panama Canal is sooner able to resume work. For the first three months of such period, following the fourth entire day of disability, the monthly compensation shall equal 75 per cent of his monthly pay, and for the remainder of such period, 50 per cent of his monthly pay.

- For the fracture of the skull, both tables, thirteen months;
- For the fracture of the thigh, twelve months;
- For the fracture of the arm between the elbow and shoulder, twelve months.
- For the fracture of the pelvis, ten months;
- For the fracture of the leg, eight months;
- For the fracture of the patella, eight months;
- For the fracture of the forearm between the wrist and elbow, six months;
- For the fracture of two or more ribs, four months;
- For the fracture of the foot, five months;
- For the fracture of the clavicle, three months;
- For the fracture of the lower jaw, three months;
- For the fracture of two or more toes, two months;
- For the fracture of two or more fingers, two months;

In all other cases of injury resulting in temporary disability, or in the event of two or more injuries listed above, the Governor shall fix the period for which compensation shall be paid, basing his decision on the relation that the injury or injuries received bears to those given above.

If before the expiration of the period for which compensation is payable, the Governor of the Panama Canal determines that the employee is capable of performing any class of work, and it is desired to continue such employee in the service, there shall be paid to the employee until the end of the period, or during such temporary partial disability, a monthly compensation equal to seventy-five per cent of the difference between

the monthly rate of compensation received by him at time of injury and the wages per month of the particular class of work which the Governor determines the employee capable of performing.

Section 6. Permanent partial disability. If the injury results in permanent partial disability, compensation shall be paid to the employee, except as provided in Section 16, until the end of the period for which compensation is payable, as fixed below. For the first three months of such period, following the fourth entire day of disability, the monthly compensation shall equal 75 per cent of his monthly pay, and for the remainder of the period, 50 per cent of his monthly pay.

(A) If the injury is included in the following list the period for which the compensation is payable as stated for such injuries may be increased by the Governor of the Panama Canal at his discretion by not to exceed fifty per cent of the period specified, having regard to the nature of the employee's trade or qualifications for work:

For the loss by separation of one arm, at or above the elbow joint or permanent or complete loss of the use of one arm, forty months;

For the loss by separation of one hand at or above the wrist joint, or the permanent and complete loss of the use of one hand, thirty-two months;

For the loss by separation of one leg at or above the knee joint, or the permanent or complete loss of the use of one leg, thirty-six months;

For the loss by separation of one foot at or above the ankle joint, or the permanent or complete loss of the use of one foot, twenty-four months;

For the permanent and complete loss of hearing in both ears, forty months;

For the permanent and complete loss of hearing in one ear, eighteen months;

For the permanent and complete loss of the sight of one eye, sixteen months;

(B) If the injury is included in the following list, the period shall be that stated for such injury:

For the loss by separation of a thumb, ten months;

For the loss by separation of a first finger, seven months; a second finger, five months; a third finger, four months; a fourth finger, three months;

The loss of one phalanx of a thumb or two phalanges of a finger shall be considered equal to the loss of one-half a thumb or finger, and compensation for one-half of the above period shall be payable;

The loss of more than one phalanx of a thumb and more than two phalanges of a finger shall be considered as the loss of an entire thumb or finger;

For the loss by separation of a great toe, compensation for eight months, and any other toe, compensation for three months will be paid.

In all other cases of injury resulting in permanent partial disability, or in the event of two or more injuries listed in clauses "A" and "B," the Governor shall fix the period for which compensation shall be paid, basing his decision on the relation that the injury or injuries bears to those given in clauses "A" and "B," provided however that in no case shall payment be made for a period greater than sixty months.

If, before the expiration of the period for which compensation is payable, the Governor of the Panama Canal determines that the employee is capable of performing any class of work, and it is desired to continue such employee in the service, there shall be paid to the employee until the end of the period, a monthly compensation equal to seventy-five per cent of the difference between the monthly rate of pay received by him at the time of injury and his wage-earning capacity per month.

Section 7. Affidavit as to Wages. After the beginning of partial disability the Governor of the Panama Canal may, from time to time, require the injured employee to make an affidavit as to the wages per month which he is receiving. In the statement of the wages, the value of rent, board, lodging and other advantages received from the employer, which can be estimated in money, shall be taken into account. If the employee at any time fails to make such affidavit, he shall not be entitled to any compensation while such failure continues, and the period of such failure shall be deducted from the period during which compensation is payable to the employee; provided, however, that if the said employee, in any such affidavit furnished, shall swear falsely with respect to any material fact within his knowledge, the compensation otherwise payable to him shall, from the time of the filing of such affidavit or the ascertainment of the falsity thereof, cease and determine.

Section 8. Refusal to work. If an employee, determined to be capable for such work, refuses to work after suitable work is furnished to or secured for him by the United States or by the Panama Railroad Company, he shall not be entitled to any compensation while such refusal continues, and the period of such refusal shall be deducted from the period during which compensation is payable to the employee.

Section 9. Sick leave. If at the time disability begins the employee has to his credit any unused sick leave, he may, at his option, subject to the approval of the Governor of the Panama Canal, use such leave until it is exhausted. During such

time no compensation under this order shall accrue, and any period of sick leave so used after the first four days of disability following the day of injury shall be deducted from the period for which compensation under this Order is payable to the employee.

Section 10. Medical, surgical and hospital treatment. There shall be furnished to the injured employee such medical, surgical and hospital service and supplies as may in the opinion of the Governor of the Panama Canal be deemed just and reasonable, except that when an injured employee not on the Isthmus of Panama elects to furnish his own physician, or to care for himself, the expense thereof is to be borne by the employee and no allowance therefor will be made under this order. If any such injured employee shall refuse to submit to the medical or surgical treatment prescribed for him and determined by the Governor of the Panama Canal to be reasonable and proper, the Governor may in his discretion either reduce the amount of compensation to which said employee might otherwise be entitled, or consider such refusal on the part of the employee to be a waiver by him of any right to compensation under this order.

Section 11. Transportation of injured employees. If in the opinion of the Governor of the Panama Canal it is not desirable to continue the injured employee in the service, such employee, so soon as he is able to travel, may be furnished, in the discretion of the Governor of the Panama Canal, transportation to his home port, or to any other port requiring no greater expenditure. If an injured employee who is a citizen of the United States desired to go to a port in the United States, the cost of transportation to which is greater than the cost to his home port, an amount may be paid towards the cost of such transportation, not in excess of the cost of transportation to his home port. In addition, an injured employee may be furnished railway transportation to or towards his home in the United States costing not in excess of \$30.00. If at the time of the injury the employee is on the Isthmus, the Governor of the Panama Canal may in his discretion suspend for such period as such employee remains on the Isthmus after free transportation has been offered, as herein provided, the compensation payable to such employee.

Section 12. Death Payments. If the injured employee shall die within one year from the date of and as the result of injuries received while directly engaged in actual work, the persons mentioned in this section, except as provided in Section 16, shall be entitled to receive compensation as set forth in the following schedule after deducting from the periods mentioned therein any period for which payment has been made to the deceased employee; provided, however, that the total amount of compensation paid to employee and beneficiaries shall not exceed the sum of \$5,000.

(A) If the deceased employee leaves a widow to whom he was married at the time of the injury, she shall be paid monthly for eight years, unless she sooner marries or dies, a sum equal to twenty-five per cent of the monthly pay of the employee.

(B) If the deceased employee leaves a widow to whom he was married at the time of the injury with one or two children incapable of self-support and dependent on her for support, there shall be paid her monthly for each such child an additional allowance of ten per cent of the monthly pay of the employee, such additional allowance to continue until the child dies, marries or in the opinion of the Governor of the Panama Canal becomes capable of self-support. If there shall be more than two children dependent on her for support the additional monthly allowance for all children shall be twenty-five per cent of the monthly pay of the employee. In no case however shall the additional monthly allowances continue beyond a period of eight years.

(C) If the deceased employee leaves a widow, or a widow and children, entitled to compensation under paragraphs A or B of this section, and also leaves another child or children incapable of self-support and not supported by the widow, there shall be paid monthly for the benefit of such child or children last named, to such person as may be designated under the provisions of Section 16, such proportions as the Governor of the Panama Canal may decide, of the deceased employee's monthly pay, not exceeding ten per cent for each such child; provided that the total proportion of monthly pay of deceased employee to widow and all children under this paragraph and paragraphs A and B of this section, shall not exceed thirty-five per cent for widow and one child, forty-five per cent for widow and two children, and fifty per cent for widow and three or more children, and; provided that in order to make payment to the children under this section the Governor may if necessary reduce the proportion payable to widow or children under paragraphs A and B of this section; and provided further that payment for the benefit of a child or children not supported by the widow shall continue until the child dies, marries, or in the opinion of the Governor becomes capable of self-support, but in no case shall such payments continue more than eight years.

(D) If the deceased employee has left no widow entitled to compensation under this order, but has left a child or children incapable of self-support, there shall be paid monthly for the benefit of such child or children to the person designated under the provisions of Section 16, not more than twenty-five per cent of the monthly pay of the deceased employee for one child and not more than fifty per cent of the monthly pay for two or more children, provided that payments shall continue until the child dies, marries, or in the opinion of the Governor becomes capable of self-support, but in no case shall such payments continue more than eight years.

(E) If the deceased employee leaves a widow or children entitled to compensation under this order and shall also leave a parent either partially or wholly dependent on him for support; or a brother, sister, grand-parent or grand-child wholly dependent on him for support, there may be paid to such relation monthly such portion or portions of the monthly pay of the employee as may be determined by the Governor of the Panama Canal, provided that the total compensation to all beneficiaries under this and paragraphs A, B, C and D of this Section shall not exceed fifty per cent of the monthly pay of the deceased employee and provided that in order to make payment to the relatives under this paragraph the Governor of the Panama Canal may if necessary reduce the proportion payable to widow or children under paragraphs A, B, C and D of this section, and; provided further that payment for the benefit of a relative under this paragraph shall cease if he dies, marries or in the opinion of the Governor becomes capable of self-support, but in no case shall payment continue more than eight years.

(F) As used in this section, the terms "child" and "children" include stepchildren, adopted children, posthumous children and illegitimate children. The terms "brother" and "sister" and their plurals include stepbrothers, and stepsisters, half brothers and half sisters, and brothers and sisters adopted by the parent of the deceased employee. The terms "grandchild" and "grandchildren" include children of adopted children, and children of stepchildren, but do not include stepchildren of children, stepchildren of stepchildren, or stepchildren of adopted children. The terms "parent" and "parents" include stepparents and the parents by whom the deceased employee was adopted. The terms "grandparent" and "grandparents" include the parents of the parents by whom the deceased employee was adopted, but do not include parents of stepparents, stepparents of parents, or stepparents of stepparents.

(G) If a beneficiary should die or for any other reason cease to be entitled to compensation under this order, the amounts payable to the remaining beneficiaries shall be recast; the amount payable to each for the remainder of the period during which he is entitled to compensation being determined in accordance with the provisions of the preceding paragraphs of this section.

Section 13. Burial expenses. If, as the result of the injury, an employee whose home is in the United States dies while on the Isthmus of Panama or while away from his home or his office, such absence being under instructions from the Panama Canal authorities, and the right to compensation has not ceased, his body, if practicable and if desired by his relatives, and if transportation has not been furnished the employee under Section 11 before his death, shall be embalmed and transported in a hermetically sealed casket to his home. If death occurs on the Isthmus and the body is not transported from the Isthmus, the body shall be interred or cremated on the Isthmus at the expense of the United States or of the Panama Railroad Company.

Section 14. Computation of pay. For the purpose of calculating compensation under this order, the monthly pay of the employee shall be taken as the basis, to be computed as provided hereunder, except that where such monthly pay so computed amounts to \$200.00 or over, \$200.00 shall be taken as the basis for computing compensation. Subject to the maximum herein fixed, monthly pay shall be computed as follows:

(A) If the employee is paid by the year, divide his yearly pay at the time of the injury by twelve;

(B) If the employee is paid by the month, take his monthly pay at the time of the injury;

(C) If the employee is paid by the week, multiply his weekly pay at the time of the injury by 52 and divide the result by 12;

(D) If the employee is paid by the day divide his daily pay at the time of the injury by the number of hours worked per day, and multiply the result by 8. When his daily rate of pay on the basis of eight hours per day has been ascertained, multiply the result by 26.

(E) If the employee is paid by the hour multiply his hourly pay at the time of the injury by eight. When his daily rate of pay on the basis of eight hours per day has been ascertained, multiply the result by 26.

(F) If the employee is paid by his output, find his daily pay at the time of the injury by dividing the total amount earned by him in the employment in which and at the rate of pay at which he was employed at the time of the injury by the number of days he was so employed during the thirty days immediately preceding the injury, then multiply the result by 26, except as provided in paragraph G. In all cases under this paragraph (F) in which the employee works more than eight hours per day and in such other cases as the Governor of the Panama Canal may deem proper he may fix the compensation that shall be paid in case of injury based upon an average wage of employees working eight hours per day in the same occupation as that of the injured employee.

(G) Payments for a fractional part of a month to or on account of employees who were on a per diem, hourly, or piece-work basis, shall be made for regular working days only, except that employees who were at time disability was incurred entitled to pay for holidays will receive pay therefor.

(H) Subsistence shall be included as a part of the pay and commutation therefor at a rate fixed by the Governor of the Panama Canal shall be paid during any period subsistence is not actually furnished to an employee entitled to subsistence.

Section 15. Commutation of periodical payments. Unless it shall appear to the Governor of the Panama Canal to be for the best interest of the United States or of the Panama Railroad Company or for the best interest of the injured employee or the beneficiary, the liability of the United States or the Panama Railroad Company for compensation to such injured employee or beneficiary shall be discharged by the payment of a lump sum which will equal the total sum of the probable future payments, capitalized at their present value calculated at four per cent per annum with annual rests. The probability of the death of the injured employee or the beneficiary before the expiration of the period for which compensation is payable shall be determined according to the American Table of Mortality. The probability of the happening of any other contingency affecting the amount or duration of the compensation shall be disregarded. Upon paying such amount all further liability on the part of the United States or Panama Railroad Company on account of such injury or death shall cease.

Section 16. The true intent and meaning of this order is to provide a fund for the injured employee, or, in the event of his death, for those beneficiaries herein provided for; and to that end payment shall be made directly to the employee as herein provided for, or to the beneficiary as herein provided for, excepting in those cases where such employee or such beneficiary is by reason of lunacy, infancy, or other legal disability not in a position to receive and give legal acquittance for such payment. In all cases of that character where the employee or beneficiary named herein is under any legal disability whatever, so that his receipt and release would not be an acquittance, the Governor of the Panama Canal shall pay the sum which would otherwise go directly to such employee or beneficiary to whomsoever has been qualified by legal proceedings to receive the same for or on account of such employee or beneficiary, if any such there be who has made application therefor to the Governor; and in the event that no such application is made to the Governor, then the Governor may appoint some one to receive the money for and on account of such employee or beneficiary so under disability, and may require such person to make such formal application with respect thereto and to furnish such bonds for the security of the money and the performance of his duties as to the Governor may seem proper.

Section 17. Notice of injury or death. Immediately after the injury, the injured employee or some one on his behalf shall give to the immediate superior of such employee notice, written if practicable, of the injury, and if the injury results in the death of the employee, one of the persons entitled to compensation or some person on his behalf shall at once give either to the immediate superior of such employee or to the Governor of the Panama Canal a written notice of such death. The notice shall state the name of the employee, his class of service, the year, month, day and hour when and the particular locality where the injury or death occurred, the cause of the injury or death, the nature of the injury, and the address of the employee and of the person giving the notice. The notice may be given personally or sent by mail.

Failure to promptly give the notice herein specified may, in the discretion of the Governor of the Panama Canal, be decided by him to be a waiver by the employee or his beneficiary of any claim to compensation under this order.

Section 18. Report of injury or death. Immediately after an injury to an employee resulting in his death or in his probable disability, the immediate superior of the employee shall at once make a report to the Governor of the Panama Canal, containing such information as the Governor of the Panama Canal may, by regulation, require.

Section 19. Claim for compensation. No compensation under this order shall be allowed to any person unless he, or someone on his behalf shall make a written claim therefor upon the Governor of the Panama Canal within the time specified in Section 21. The claim may be served personally upon or sent by mail either to the Governor of the Panama Canal or to such person as he may, by regulation, require.

Section 20. Contents of claim. The claim shall be signed by or on behalf of the person making the claim and shall state the name of the employee, the age, sex, nationality and class of service of such employee, the year, month, day and hour when and the particular locality where the injury or death occurred, the cause of the injury or death, the nature of the injury, the nature and extent of the disability resulting therefrom; the monthly pay of the employee at the time of the injury, the relationship to the employee of the person claiming to be entitled to compensation, the names and addresses of all persons entitled to compensation on account of such injury or death, and the address of the person making the claim. The claim shall be sworn to by the person entitled to compensation or by the person acting on his behalf, and, except in case of death, or as otherwise provided in regulations prescribed by the Governor of the Panama Canal, shall be accompanied by a certificate of the employee's physician, if any, stating the nature of the injury, and the nature and extent of the disability. The claim shall, wherever possible, be made on forms furnished by the Governor of the Panama Canal, and in addition to the statements above required, shall contain such other information as the Governor of the Panama Canal may require.

The Governor of the Panama Canal may waive the making of and swearing to claims and the inclusion therein of any of the above requirements in such cases as he may deem proper.

Section 21. Time within which claim must be made. Claims for compensation shall be made within sixty days after the beginning of disability resulting from an injury, or, in case of death, within one year after the death. For any reasonable cause shown, the Governor of the Panama Canal may allow claim for injury to be filed within one year after the injury.

No claim for compensation shall be allowed where the disability commences more than six months after the occurrence of the alleged injury, nor where the disability begins after the separation of the employee from the service.

Section 22. Medical examination. After the injury and during disability the employee shall as frequently and at such times and places as may be reasonably required submit himself to examination by a medical officer of the United States or by a physician designated by the Governor of the Panama Canal and paid by the United States or by the Panama Railroad Company, as the case may be. The employee may have a duly qualified physician designated and paid by him present to participate in such examination. If an examination of an employee is ordered while he is away from the Isthmus of Panama, and such order requires him to travel from the place wherein he dwells, then he shall be paid his reasonable traveling and other expenses and loss of wages incurred in order to submit to such examination. If the employee refuses to submit himself for or in any way obstructs any examination, his right to claim compensation under this order shall be suspended until such refusal or obstruction ceases. No compensation shall be payable while such refusal or obstruction continues and such period shall be deducted from the period for which the compensation would otherwise be payable.

Section 23. Disagreement between physicians. In case of any disagreement between the physician making an examination on the part of the United States or the Panama Railroad Company and the employee's physician, the Governor of the Panama Canal shall appoint a third physician. The decision of the majority shall be final. A reasonable fee shall be allowed and paid by the United States or by the Panama Railroad Company, as the case may be, to such third physician if he is not a medical officer of the United States.

Section 24. Assignment of right against third person. If an injury or death for which compensation is payable under this order is caused under circumstances creating a legal liability upon some person other than the United States or the Panama Railroad Company to pay damages therefor, no compensation shall be payable to any beneficiary for such injury or death until he assigns to the United States or to the Panama Railroad Company, as the case may be, any right of action which he may have to enforce such liability of such other person, or any right which he may have to share in any money (or other property) received in satisfaction of such liability of such other person. The United States or the Panama Railroad Company, as the case may be, if it realizes upon such right shall after deducting the amount of any compensation already paid to the beneficiary and the expenses of such realization or collection, pay over to the beneficiary any surplus remaining. Such surplus so paid over shall be

credited on future instalments of compensation as they become due. The Governor of the Panama Canal may waive the requirement of such assignment or may waive it for such period as he may deem proper.

Section 25. Assignment of right against Panama Railroad Company. If an injury or death for which compensation is payable under this order is caused under circumstances creating a legal liability upon the Panama Railroad Company to pay damages therefor under the laws of the United States or of any State, Territory or possession of the United States or of the District of Columbia or of any foreign country, no compensation shall be payable to any beneficiary for such injury or death until he releases to the Panama Railroad Company, any right of action which he may have to enforce such liability of the Panama Railroad or until he assigns to the United States or to the Panama Railroad Company, as the case may be, any right which he may have to share in any money (or other property) received in satisfaction of such liability of the Panama Railroad Company. The Governor of the Panama Canal may waive the requirement of such assignment or release for such period as he may deem proper.

Section 26. Assignments and attachments. No claims for compensation under this order shall be assignable, and all compensation and claims therefor shall be exempt from all claims of creditors.

Section. 27. Attorneys' fees. No claim for legal services in connection with any claim arising under this order shall be enforceable unless approved by the Governor of the Panama Canal.

Section 28. Modification of allowance of compensation. The Governor of the Panama Canal may at any time review, and, in accordance with his determination thereon, end, diminish, or increase any compensation previously fixed or determined.

Section 29. Recovery of compensation erroneously paid. If any compensation is paid under mistake of law or of fact the Governor of the Panama Canal shall have power to cancel any order under which such compensation has been paid, and shall be entitled to recover whatever has been so paid.

Section 30. Powers of the Governor of the Panama Canal. The Governor of the Panama Canal shall make all necessary rules and regulations for the proper, effective, and economical enforcement of this order, and shall decide all questions arising under this order or in regard to the interpretation thereof. His determination of any fact necessary to or underlying any claim hereunder, shall be final and conclusive.

Section 31. Singular, masculine and person. Wherever used in this order the singular includes the plural and vice versa, and the masculine gender includes the feminine and neuter, and the word "person" includes any firm, association or corporation.

Section 32. Liability of the United States and of the Panama Railroad Company. If the payment of compensation under this order on account of an injury or death is from the funds of the United States, the Panama Railroad Company shall be released and discharged from all liability on account of such injury or death, and if it is from the funds of the Panama Railroad Company, the United States shall be released and discharged from all liability on account of such injury or death.

Section 33. Repeal of laws of Canal Zone. All laws of the Canal Zone inconsistent with any of the provisions of this order are hereby repealed.

Section 34. Time of taking effect. This order shall take effect on April 1, 1914.

WOODROW WILSON

THE WHITE HOUSE,
March 20, 1914.

[No. 1902.]

EXECUTIVE ORDER.

Establishing Regulations Relative to the Payment of Tolls and of Bills for Materials, Supplies, Repairs, Harbor Pilotage, Towage, and Other Services, Furnished to Vessels by the Panama Canal.

By virtue of authority vested in me under the Panama Canal Act, the following regulations relative to the payment of tolls and of bills for materials, supplies, repairs, harbor pilotage, towage, and other services, furnished to vessels by the Panama Canal, are hereby prescribed:

1. The payment of tolls by vessels using the Panama Canal, and the payment for fuel and for other material and supplies sold, and for repairs, harbor pilotage, towage and other services furnished by the Panama Canal to vessels, shall be made to the Col-

lector of the Panama Canal at either the Port of Balboa or Cristobal, except that deposits for tolls may be made with the Treasurer or an Assistant Treasurer of the United States to the official credit of the Collector of the Panama Canal, as authorized in Paragraph 6 hereof.

A vessel may enter Gatun Lake from either end of the Canal and may, without passing through the locks at the other end, return to the original point of entry of the Canal without payment of additional tolls.

2. All payments shall be made in lawful money of the United States, but, in order to facilitate such payments, drafts may be accepted for conversion into lawful money under the conditions provided for in Paragraph 5 hereof.

3. Payment of tolls shall be made, or full secured as provided for in either Paragraph 5 or 6 hereof, before the vessel is allowed to enter any lock of the Panama Canal. All bills for materials, supplies, repairs, harbor pilotage, towage, and other services furnished by the Panama Canal to vessels shall be paid, or full secured as provided for in either Paragraph 5 or 6 hereof, before clearance papers are issued from the port of departure.

4. A certificate that the vessel is entitled to pass through the locks of the Canal may be issued to the officer in charge of the operation of the locks and, if desired, to the master of the vessel by the Auditor of the Panama Canal. The Auditor shall certify that the tolls have been paid to the Collector, or that their payment has been secured as provided in either Paragraph 5 or 6 hereof, or that the vessel is entitled to passage. Before a vessel that passes through the Canal is cleared from the port of departure, all statistical data in regard to cargo and passengers required by the regulations prescribed by the Governor of the Panama Canal shall be furnished to the Auditor, or arrangements to furnish same, satisfactory to the Auditor, shall have been made through an agency on the Isthmus. When all bills are paid, or secured as provided in either Paragraph 5 or 6 hereof, and the statistical data furnished or satisfactorily arranged for, the Auditor will issue a certificate to that effect to the port captain charged with the duty of clearing the vessel.

5. Unless, in the opinion of the Governor of the Panama Canal, payment in cash to the Collector of the Panama Canal is necessary for Canal purposes, drafts on banks in the United States under the supervision of the Comptroller of the Currency and otherwise satisfactory to the Governor of the Panama Canal, may be accepted for conversion into cash to effect payment of tolls and for bills for materials and supplies, repairs, harbor pilotage, towage and other services, provided the payment of such drafts is secured by deposit of high-grade bonds with the official of the Panama Canal designated by the Governor of the Panama Canal under the following conditions:

Bonds will be acceptable only from steamship companies having frequent sailings through the Canal or from the agents of several vessels or steamship companies. The bonds deposited by any one agency or company shall be sufficient to cover the tolls on a minimum number of vessels, as fixed by the Governor of the Panama Canal. Bonds of the United States, the Philippines, Porto Rico, and the District of Columbia will be accepted at their par value. If otherwise satisfactory to the Governor of the Panama Canal or his representative, bonds of the Hawaiian Territory, the Philippine Railway Company and those of states, municipalities and high grade railroads, such as are legal investments for savings banks in the States of New York, Massachusetts, Connecticut or New Jersey, will be accepted at 90 per cent of their market value, but not exceeding 90 per cent of their par value.

The Governor of the Panama Canal may refuse to accept coupon bonds and may limit exchanges of bonds by depositors.

6. Steamship companies or agencies may make deposits to the official credit of the Collector of the Panama Canal with the Treasurer or any Assistant Treasurer of the United States to be applied in payment of tolls. The Treasurer or Assistant Treasurer receiving a deposit will forward a copy of the receipt direct to the Auditor of the Panama Canal at Balboa, Canal Zone. The receipt shall specify the vessel or vessels the tolls on which are to be charged against the deposit. Upon request a cable notice will be sent to the Auditor of the Panama Canal. Request in writing that cable notice be sent will be made upon the Treasurer or Assistant Treasurer receiving the deposit. He will telegraph the Washington Office of the Panama Canal, giving the number and date of the certificate of deposit, the amount paid, and the vessel or vessels for which the deposit is made, and state that cable notice is requested. The cost of sending the cable will be paid by the Panama Canal and the fees prescribed for such services will be charged against the deposit. The Auditor of the Panama Canal will issue monthly a certificate of the amount of tolls and fees charged against deposits with the Treasurer or Assistant Treasurer of the United States. Upon such certificate the Collector of the Panama Canal will draw his check for the proper part of the deposits to be covered into the Treasury as moneys received in payment of tolls, or as a credit to the Panama Canal funds as the case may require.

7. A refund of any excess amount deposited in payment of tolls with the Treasurer or Assistant Treasurer of the United States will be made when the steamship company or other agency making the deposit ceases to act for the vessels passing through the canal, or, when, on notice to the Governor, the amount is to be withdrawn.

Application for refund shall be made to the Auditor of the Panama Canal who, upon approval of the Governor, will state the account and certify the amount to be refunded to the Collector of the Panama Canal who shall then draw his check for the amount of the refund to be made.

8. The Governor of the Panama Canal may prescribe such additional detailed regulations as may be necessary and proper.

WOODROW WILSON

THE WHITE HOUSE,
16 April, 1914.

[No. 1917.]

EXECUTIVE ORDER.

By direction of the President it is ordered:

That Levi Monroe Kagy and David Marks, who have been appointed members of the Joint Commission for the appraisalment and settlement of damages to property in the Canal Zone, in accordance with the provisions of Articles Six and Fifteen of the Convention between the United States and Panama, concluded November 18, 1903, be allowed Twenty-five (\$25) Dollars per day for their services, including all expenses, from the time of their sailing from New York until their return thither; provided that they shall be granted free transportation on the Panama Railroad Steamship Line from New York to the Isthmus and return, free transportation over the Panama railroad, and such other transportation as may be necessary when traveling on official business on the Isthmus; they shall also be allowed the ordinary privileges of Government employees on the Isthmus, including employees' rates at the hotels of the Panama Canal or the Panama Railroad Company on the Isthmus.

LINDLEY M. GARRISON,
Secretary of War.

WAR DEPARTMENT,
Washington, D. C., May 8, 1914.

EXECUTIVE ORDER.

WAR DEPARTMENT,
Washington, May 13, 1914.

All acts and resolutions of the Isthmian Canal Commission passed since February 28, 1907, in so far as they effect changes in the "Laws of the Canal Zone" or other enactments of the Commission relative to the Government of the Canal Zone prior to March 4, 1905, in so far as they have not been specifically approved or modified, are hereby approved.

By order of the President.

LINDLEY M. GARRISON,
Secretary of War.

EXECUTIVE ORDER.

Relating to Pardons, the Remission of Fines and Forfeitures and Other Subjects.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

Section 1. The Governor of the Panama Canal is hereby empowered to grant pardons and reprieves for offenses against the laws, orders and regulations of the Canal Zone; and to commute sentences, and remit fines and forfeitures. He may establish a system for paroling prisoners, and alter or amend the same from time to time.

Section 2. The Governor may establish regulations to govern the labor and employment of prisoners, and to provide awards for their good behavior, and upon other matters affecting the welfare of the prisoners and their management in the penal institutions of the Canal Zone, and may alter and amend such regulations from time to time.

The existing rules and regulations upon the subjects mentioned in this section shall continue in force until altered or amended by the Governor.

Section 3. This order shall take effect from and after this date.

WOODROW WILSON.

THE WHITE HOUSE, 13 May, 1914.

[No. 1933.]

EXECUTIVE ORDER.

To Create a Committee to Formally and Officially Open The Panama Canal.

By virtue of authority vested in me by the Act approved April 6, 1914, entitled "An Act Making appropriations to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and fourteen and for prior years, and for other purposes," a committee of six members is hereby created to arrange and provide suitable ceremonies for the official and formal opening of the Panama Canal, as is provided for in Section 4 of the Panama Canal Act. The committee shall be composed of persons who were members of the Isthmian Canal Commission. The committee shall be known and referred to as the "Committee for the Formal and Official Opening of the Panama Canal." It shall have a chairman and vice chairman, but shall perform its duties under the direction of the Governor of the Panama Canal.

The persons named below are hereby appointed members of this committee:

Colonel George W. Goethals, U. S. A.

Honorable Richard L. Metcalfe.

General William C. Gorgas, U. S. A.

Colonel H. F. Hodges, U. S. A.

Lieutenant Colonel William L. Sibert, U. S. A.

Civil Engineer, H. H. Rousseau, U. S. N.

Colonel George W. Goethals, now Governor of the Panama Canal, shall be Chairman of this committee.

Honorable Richard L. Metcalfe shall be Vice Chairman.

The members of said committee shall each receive salary at the rate of \$10,000 per annum from April 1, 1914, to December 31, 1914, inclusive, and such necessary traveling and living expenses during the period from April 1, 1914, to January 31, 1915, when on duty connected with the work of providing for formally and officially opening the Panama Canal, as may be approved by the Secretary of War. The salary fixed as above shall include any salary to which any member of this committee may be entitled by reason of his appointment to or employment in any other position under the United States for the period above provided for, and the amount of such salary shall be deducted from the salary fixed as above. The salary to be paid May 31, 1914, shall be equal to two months' pay in a lump sum, less the amount of any other salary for the months of April and May, 1914. The word "salary" as used herein, in determining the amount to be deducted, shall not be construed to include additional emoluments, such as quarters, heat, light, etc., but shall be confined to actual pay.

The committee is authorized to spend such sums as may be available for printing, postage, correspondence, employment of clerks, and other necessary expenses connected with formally and officially opening the Panama Canal, as may be approved by the Secretary of War, it being understood that the sum to be expended for traveling, living, and other expenses shall not exceed \$10,000, and that the total expenditure authorized by this order shall not exceed \$25,000.

The payments herein authorized shall be made from such appropriation or appropriations for the construction, completion, and sanitation of the Panama Canal as may be directed by the Governor of the Panama Canal.

The payments authorized hereunder shall be made by such disbursing officer of the Panama Canal as the Governor shall designate.

The Secretary of War shall provide the manner in which the amount to be expended for traveling, living and other expenses authorized by him shall be certified to, and, when such expenditures are so certified to, they shall be paid without further vouchers therefor.

WOODROW WILSON.

THE WHITE HOUSE, 20 May, 1914.

[No. 1944.]

EXECUTIVE ORDER.

The area of land hereinafter described, situated in the Canal Zone, is hereby set apart and assigned to the uses and purposes of a radio station and other naval purposes under the control of the Secretary of the Navy; but said area shall be subject to the civil jurisdiction of the Canal Zone authorities in conformity with the Panama Canal Act.

The said area is described as follows:

BALBOA NAVAL RADIO STATION.

Starting at a concrete and rail monument marked "W" on the map, and located at the southeast corner of the oil fuel storage site on Balboa dump, go on an azimuth of 307°-40' for a distance of 1,050 feet to a similar monument marked "Z" on the map; thence on an azimuth of 217°-40' for a distance of 780 feet to a similar monument located on top of the dump on the shore of the bay and marked "V" on the map; thence along the top of the dump following the shore to a similar monument marked "Y" on the map; thence on an azimuth of 37°-40' and for a distance of 1,120 feet to the point of the beginning; all as shown by the blue print, No. 3836, dated January 30, 1914, issued by the Department of Construction and Engineering, Isthmian Canal Commission, office of the Assistant to the Chief Engineer.

WOODROW WILSON.

THE WHITE HOUSE, 26 May, 1914.

[No. 1948.]

EXECUTIVE ORDER.

Amending the Civil Service Rules.

* * * * *
The following sections are hereby added to Rule X:

* * * * *

12. No person appointed in the Isthmian Canal Service otherwise than through competitive examination, or by transfer or promotion from a competitive position, shall be transferred to a competitive position, unless he was classified by the Executive Order of November 15, 1904, in a position which was then and is at the time of the proposed transfer in the competitive service: *Provided*, That artisans who are citizens of the United States, who have rendered one year's satisfactory service on the Isthmus of Panama, and who may be recommended, upon discharge, for transfer, may be transferred without examination within three years to corresponding classified positions in or under any department or office, subject to the provisions of these rules.

* * * * *

The foregoing provisions are now contained in Executive Orders and are made a part of the Civil Service Rules upon recommendation of the Civil Service Commission that they may be more easily referred to and greater publicity given to their existence.

WOODROW WILSON.

THE WHITE HOUSE, 15 June, 1914.

[No. 1964.]

APPENDIX M.

CHARTS SHOWING ORGANIZATION OF THE PANAMA CANAL AND PANAMA RAILROAD CO., JULY, 1914.

INDEX.

(For plates, see portfolio.)

	Plate.
General organization.....	137
Executive department.....	138
Engineer of maintenance.....	139
Division of terminal construction.....	140
Dredging division.....	141
Mechanical division.....	142
Division of canal transportation.....	143
Supply department.....	144
Accounting department.....	145
Health department.....	146
Washington office.....	147
Panama Railroad Co.....	148



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